Vertex AI Agent Team Map for Financial Advisory

This document provides a detailed breakdown of each AI agent team, including their specific agents, roles, key Vertex AI services utilized, data sources, and configuration notes. This architecture is designed to be modular and leverage serverless components for cost-effectiveness, aligning with a free-tier usage model where possible.

Overall Architecture Components (Shared Across Teams)

- **User Interface (Web/Mobile App):** The front-end application where users interact with the AI agents.
- **API Gateway (Cloud Endpoints):** Acts as the single entry point for all user requests, routing them to the appropriate backend services.
- **Orchestration Layer (Cloud Run Service):** A central service responsible for:
  - **Request Routing:** Directing incoming user requests to the relevant agent team.
  - **Agent Coordination:** Managing the flow of tasks between different agents within a team or across teams.
  - **Response Synthesis:** Consolidating outputs from various agents into a coherent response for the user.
- **Vertex AI Generative AI Studio:** The primary service for integrating Large Language Models (LLMs) for natural language understanding, generation, summarization, sentiment analysis, and conversational AI.
- **Cloud Run:** For deploying containerized microservices that house the core logic of each agent. Its auto-scaling and "scale to zero" capabilities are crucial for cost optimization.
- **Cloud Functions:** For event-driven tasks, lightweight data processing, and triggering specific agent actions.
- **Cloud Storage:** For storing raw data, documents, and large datasets that don't require immediate querying.
- **BigQuery:** For analytical data storage, especially for structured, time-series, or large datasets requiring complex queries.
- **Firestore (NoSQL Database):** For storing structured data like user profiles, agent configurations, and aggregated results. Offers flexibility and a generous free tier.
- **Pub/Sub:** For asynchronous communication between services, ensuring decoupling and resilience.
- **Cloud Monitoring & Logging:** Essential for observing agent performance, debugging issues, and tracking resource usage.

Team 1: Financial News Analyzer

Overall Goal: To get market sentiment by analyzing news articles on a particular entity (stocks, commodities, mutual funds, etc.) that the user asks for.

Agents:

1. **News Fetcher Agent**
    - **Role/Responsibility:**
        - Receives requests for news on specific entities.
        - Fetches relevant news articles from various sources.
        - Stores raw news content for further processing.
    - **Key Vertex AI Services:**
        - **Cloud Functions:** Triggered by Pub/Sub messages from the Orchestration Layer or on a schedule for proactive fetching.
        - **Cloud Storage:** For storing raw news articles (text, HTML).
    - **Data Sources:**
        - External: Google Search API (for news search), RSS feeds from financial news outlets, potentially specialized news APIs (check free tier availability).
    - **Tools/APIs:** google_search tool.
    - **Configuration Notes:** Implement rate limiting for external APIs. Optimize Cloud Function execution time and memory to stay within free tier.
2. **Sentiment Analysis Agent**
    - **Role/Responsibility:**
        - Processes raw news articles to extract sentiment (positive, negative, neutral).
        - Identifies key themes and summaries from the articles.
    - **Key Vertex AI Services:**
        - **Vertex AI Generative AI Studio:** Utilizes LLMs (e.g., gemini-pro) for text summarization and sentiment analysis.
        - **Cloud Run:** Deploys a service to orchestrate LLM calls and process batches of news articles.
    - **Data Sources:**
        - Internal: Raw news articles from Cloud Storage.
    - **Tools/APIs:** Internal processing.
    - **Configuration Notes:**
        - **Prompt Engineering:** Carefully craft prompts for the LLM to accurately extract sentiment and summarize financial news, considering nuances.
        - **Model Tuning:** If initial results are not satisfactory, consider fine-tuning a

base model on a small, labeled dataset of financial news (use Vertex AI Workbench for this, but be mindful of costs).
        - **Cost Optimization:** Batch processing of articles to reduce individual LLM call overhead.
3. **Entity Linker Agent**
    - **Role/Responsibility:**
        - Connects extracted sentiment and summaries to specific financial entities requested by the user.
        - Aggregates sentiment across multiple articles for a given entity.
    - **Key Vertex AI Services:**
        - **Vertex AI Generative AI Studio:** LLMs for entity recognition within news text.
        - **Cloud Run:** Hosts the agent logic.
        - **Firestore:** Stores a mapping of entities to their aggregated sentiment scores.
    - **Data Sources:**
        - Internal: Sentiment-analyzed news articles.
        - External: Financial entity databases (e.g., stock tickers, company names).
    - **Tools/APIs:** Internal processing.
    - **Configuration Notes:** Ensure robust entity disambiguation, especially for common names or acronyms.

Team 2: Chart Analyzer

Overall Goal: To work on a single market entity to understand trends, suggest actions, simulate scenarios, or visualize outcomes, and suggest positions on that particular stock.

Agents:

1. **Market Data Ingestion Agent**
    - **Role/Responsibility:**
        - Fetches historical and real-time market data (stock prices, volume, etc.) for specified tickers.
        - Stores data in an optimized format for analysis.
    - **Key Vertex AI Services:**
        - **Cloud Functions:** Triggered periodically or on demand.
        - **BigQuery:** Ideal for storing large volumes of time-series market data.
    - **Data Sources:**
        - External: Public market data APIs (e.g., Alpha Vantage, Yahoo Finance API – *note: research free tier limits and usage policies*).

- **Tools/APIs:** External market data APIs.
- **Configuration Notes:** Implement robust error handling for API calls. Optimize BigQuery schema for efficient querying.

2. **Trend Analysis Agent**
   - **Role/Responsibility:**
     - Applies technical analysis indicators (e.g., Moving Averages, RSI, MACD) to market data.
     - Identifies trends, support/resistance levels, and patterns.
   - **Key Vertex AI Services:**
     - **Vertex AI Workbench:** For developing and running Python-based data analysis scripts (Pandas, NumPy, TA-Lib).
     - **Cloud Run:** Deploys the analysis logic as a microservice.
     - **Vertex AI Generative AI Studio:** For interpreting the results of technical analysis in natural language (e.g., "RSI indicates overbought conditions").
   - **Data Sources:**
     - Internal: Historical market data from BigQuery.
   - **Tools/APIs:** Python libraries for technical analysis.
   - **Configuration Notes:** Focus on common, computationally inexpensive indicators for free-tier optimization.
3. **Scenario Simulation Agent**
   - **Role/Responsibility:**
     - Allows users to define hypothetical scenarios (e.g., "What if I invested X amount when stock Y was at Z price?").
     - Simulates potential outcomes based on historical data and user input.
   - **Key Vertex AI Services:**
     - **Cloud Run:** Hosts custom simulation logic.
     - **Vertex AI Workbench:** For developing complex financial models.
   - **Data Sources:**
     - Internal: Historical market data from BigQuery.
     - User Input: Hypothetical investment parameters.
   - **Tools/APIs:** Custom financial modeling scripts.
   - **Configuration Notes:** Keep simulations relatively simple to manage compute costs.
4. **Visualization Agent**
   - **Role/Responsibility:**
     - Generates interactive charts and visualizations of market data, trends, and simulation outcomes.
   - **Key Vertex AI Services:**
     - **Cloud Run:** Deploys a lightweight service to generate chart data or serve

static chart files.
        - **Cloud Functions:** Can be used to generate simple chart images on demand.
    - **Data Sources:**
        - Internal: Market data, trend analysis results, simulation outcomes.
    - **Tools/APIs:** Python libraries like Matplotlib, Plotly (for generating images/JSON for client-side rendering).
    - **Configuration Notes:** Prioritize client-side rendering of charts if possible to offload compute from GCP. If server-side rendering, optimize image generation.

Team 3: Loan/Insurance Advisor

Overall Goal: To analyze all available loan and insurance options and suggest the best one as per user's finances.

Agents:

1. **Option Scraper/Aggregator Agent**
    - **Role/Responsibility:**
        - Collects data on various loan products (interest rates, terms, eligibility) and insurance policies (coverage, premiums, exclusions) from public websites.
        - Aggregates and standardizes this data.
    - **Key Vertex AI Services:**
        - **Cloud Run:** For deploying web scraping bots (be mindful of website terms of service and legal implications).
        - **Cloud Functions:** For scheduled data collection.
        - **Cloud Storage:** For raw scraped data.
        - **Firestore/BigQuery:** For structured storage of product information.
    - **Data Sources:**
        - External: Public loan/insurance provider websites, financial product aggregators.
    - **Tools/APIs:** Web scraping libraries (e.g., Beautiful Soup, Scrapy within a Cloud Run container).
    - **Configuration Notes:** Implement polite scraping practices. Regularly review and update scraping logic as websites change.
2. **Financial Data Fetcher Agent**
    - **Role/Responsibility:**
        - Securely accesses the user's provided financial data.
        - Pre-processes and validates the data for use by other agents.

- **Key Vertex AI Services:**
  - **Cloud Functions:** Triggered by user requests (e.g., when a user uploads their data).
  - **Firestore:** Securely stores user-specific financial data.
- **Data Sources:**
  - User Provided: fetch_bank_transactions.json, fetch_credit_report.json, fetch_net_worth.json.
- **Tools/APIs:** Internal data parsing and validation.
- **Configuration Notes: Crucial for data security and privacy.** Ensure robust authentication, authorization, and encryption for user data.

3. **Eligibility & Comparison Agent**
   - **Role/Responsibility:**
     - Compares available loan/insurance options against the user's financial profile and stated needs.
     - Determines eligibility for various products.
     - Calculates key metrics (e.g., EMI for loans, effective premium for insurance).
   - **Key Vertex AI Services:**
     - **Cloud Run:** Hosts the comparison logic.
     - **Vertex AI Generative AI Studio:** Utilizes LLMs for complex rule-based comparisons and for generating initial explanations of eligibility criteria.
   - **Data Sources:**
     - Internal: Loan/insurance product data, user financial data.
   - **Tools/APIs:** Custom comparison algorithms.
   - **Configuration Notes:** Design clear, auditable comparison rules.
4. **Recommendation Agent**
   - **Role/Responsibility:**
     - Generates personalized recommendations for loans or insurance policies based on the comparison results and user preferences.
     - Provides clear explanations for the recommendations.
   - **Key Vertex AI Services:**
     - **Vertex AI Generative AI Studio:** LLMs are key for generating human-like, personalized, and easy-to-understand advice.
     - **Cloud Run:** Orchestrates the recommendation generation.
   - **Data Sources:**
     - Internal: Eligibility and comparison results.
     - User Input: Preferences (e.g., lowest interest, flexible terms).
   - **Tools/APIs:** Internal logic for ranking and explanation generation.
   - **Configuration Notes: Ethical AI considerations are paramount.** Ensure

recommendations are unbiased, transparent, and clearly state assumptions or limitations.

Team 4: Investment

Overall Goal: To guide investment strategy, optimize debt, project long-term goals, and detect financial anomalies. This is a critical team requiring robust analysis.

Agents:

1. **Portfolio Analysis Agent**
    - **Role/Responsibility:**
        - Analyzes the user's current investment portfolio (stocks, mutual funds, etc.).
        - Assesses diversification, risk exposure, and performance.
    - **Key Vertex AI Services:**
        - **Vertex AI Workbench:** For running complex analytical scripts using Python (e.g., for calculating portfolio metrics, risk-adjusted returns).
        - **Cloud Run:** Deploys the analysis as a microservice.
        - **Vertex AI Generative AI Studio:** For generating insights and summaries of portfolio performance in natural language.
    - **Data Sources:**
        - User Provided: fetch_mf_transactions.json, fetch_bank_transactions.json, fetch_net_worth.json.
        - External: Market data for asset pricing (from Team 2's data).
    - **Tools/APIs:** Financial analysis libraries (e.g., Pandas, NumPy, PyPortfolioOpt).
    - **Configuration Notes:** Define clear metrics for portfolio evaluation.
2. **Debt Optimization Agent**
    - **Role/Responsibility:**
        - Analyzes the user's outstanding debts (loans, credit cards).
        - Suggests strategies for debt reduction or optimization (e.g., avalanche method, snowball method, refinancing).
    - **Key Vertex AI Services:**
        - **Cloud Run:** Hosts the optimization logic.
        - **Vertex AI Generative AI Studio:** For explaining debt strategies and their potential impact.
    - **Data Sources:**
        - User Provided: fetch_credit_report.json, fetch_bank_transactions.json.
    - **Tools/APIs:** Custom algorithms for debt optimization.
    - **Configuration Notes:** Prioritize actionable and realistic advice.
3. **Long-Term Goal Projection Agent**

- **Role/Responsibility:**
  - Projects the user's financial standing based on current assets, savings, and defined long-term goals (e.g., retirement, home purchase).
  - Simulates different savings rates or investment returns.
- **Key Vertex AI Services:**
  - **Cloud Run:** Hosts financial modeling logic.
  - **Vertex AI Generative AI Studio:** For interpreting projections and suggesting adjustments to reach goals.
- **Data Sources:**
  - Internal: User financial data, investment performance data.
  - User Input: Financial goals, time horizons.
- **Tools/APIs:** Custom financial projection models.
- **Configuration Notes:** Clearly state assumptions used in projections.

4. **Anomaly Detection Agent**
   - **Role/Responsibility:**
     - Monitors user's financial transactions and credit report for unusual or potentially fraudulent patterns.
     - Alerts the user to detected anomalies.
   - **Key Vertex AI Services:**
     - **Vertex AI Workbench:** For training and deploying machine learning models (e.g., Isolation Forest, Autoencoders) for anomaly detection.
     - **Cloud Run:** Deploys the inference endpoint for the anomaly detection model.
     - **BigQuery ML:** Can be used for simpler anomaly detection directly on BigQuery data.
   - **Data Sources:**
     - User Provided: fetch_bank_transactions.json, fetch_credit_report.json, fetch_mf_transactions.json.
   - **Tools/APIs:** Machine learning libraries (Scikit-learn, TensorFlow).
   - **Configuration Notes:** Requires careful model training and threshold setting to minimize false positives/negatives.

Team 5: Tax Advisor

Overall Goal: To devise strategies and suggestions for optimal tax saving.

Agents:

1. **Tax Rule Base Agent**
   - **Role/Responsibility:**
     - Maintains and provides access to a comprehensive knowledge base of tax

laws, regulations, and deductions.
        - Interprets tax rules for other agents.
    - **Key Vertex AI Services:**
        - **Cloud Storage:** For storing tax documents (PDFs, text files).
        - **Vertex AI Search (formerly Enterprise Search):** Potentially for building a Retrieval Augmented Generation (RAG) system to efficiently retrieve relevant tax information.
        - **Vertex AI Generative AI Studio:** For interpreting and summarizing complex tax rules.
    - **Data Sources:**
        - External: Official tax publications, government websites, tax advisory resources.
    - **Tools/APIs:** Text processing, RAG framework.
    - **Configuration Notes:** Regular updates to the tax rule base are crucial.
2. **Income/Expense Analyzer Agent**
    - **Role/Responsibility:**
        - Processes the user's bank transactions, EPF details, and other financial records to categorize income and expenses relevant for tax calculation.
        - Identifies potential deductions and tax-saving opportunities.
    - **Key Vertex AI Services:**
        - **Cloud Run:** Hosts the data processing logic.
        - **Vertex AI Generative AI Studio:** For categorizing unstructured transaction descriptions.
    - **Data Sources:**
        - User Provided: fetch_bank_transactions.json, fetch_epf_details.json.
        - User Input: Other income/expense details.
    - **Tools/APIs:** Custom parsing and categorization logic.
    - **Configuration Notes:** Requires robust categorization rules and potentially user feedback for refining categories.
3. **Tax Optimization Agent**
    - **Role/Responsibility:**
        - Combines tax rules with user's financial data to suggest personalized tax-saving strategies.
        - Calculates potential tax savings from different strategies.
    - **Key Vertex AI Services:**
        - **Vertex AI Generative AI Studio:** Crucial for generating clear, actionable, and compliant tax advice.
        - **Cloud Run:** Orchestrates the tax calculation and strategy generation.
    - **Data Sources:**

        - Internal: Tax rule base, user's analyzed income/expenses.
    - **Tools/APIs:** Custom tax calculation logic.
    - **Configuration Notes: Legal and compliance accuracy is paramount.** The agent should always advise consulting a human tax professional for final decisions.

Team 6: Wealth Management

Overall Goal: To provide natural-language financial conversations, answer questions like “How much money will I have at 40?”, “How’s my net worth growing?”, and “Can I afford a ₹50L home loan?”.

Agents:

1. **Conversation Agent**
    - **Role/Responsibility:**
        - Handles natural language input from the user.
        - Identifies user intent and extracts relevant entities from the conversation.
        - Generates human-like responses.
    - **Key Vertex AI Services:**
        - **Vertex AI Generative AI Studio:** The core for conversational AI, including intent recognition, entity extraction, and response generation using LLMs.
        - **Cloud Run:** Deploys the conversational interface.
    - **Data Sources:**
        - User Input: Natural language queries.
    - **Tools/APIs:** Integrated with other agents for data retrieval.
    - **Configuration Notes:** Extensive prompt engineering for natural, empathetic, and accurate conversational flow. Implement robust error handling for misunderstood intents.
2. **Net Worth Tracker Agent**
    - **Role/Responsibility:**
        - Calculates the user's current net worth based on assets and liabilities.
        - Tracks net worth growth over time.
    - **Key Vertex AI Services:**
        - **Cloud Functions:** Triggered to calculate net worth.
        - **BigQuery:** Stores historical net worth data for trend analysis.
    - **Data Sources:**
        - User Provided: fetch_net_worth.json, fetch_bank_transactions.json, fetch_mf_transactions.json, fetch_epf_details.json.
    - **Tools/APIs:** Internal calculation logic.
    - **Configuration Notes:** Ensure all asset and liability categories are accounted

for.

3. **Affordability Analysis Agent**
    - **Role/Responsibility:**
        - Determines the user's affordability for significant purchases (e.g., a home loan).
        - Considers income, expenses, existing debts, and potential loan terms.
    - **Key Vertex AI Services:**
        - **Cloud Run:** Hosts financial calculation logic.
        - **Vertex AI Generative AI Studio:** For explaining affordability scenarios and implications in natural language.
    - **Data Sources:**
        - Internal: User financial data (from Financial Data Fetcher Agent).
        - User Input: Purchase price, desired loan amount/terms.
    - **Tools/APIs:** Financial calculation libraries.
    - **Configuration Notes:** Integrate with the Loan/Insurance Advisor team for up-to-date loan product information.
4. **Goal Progress Agent**
    - **Role/Responsibility:**
        - Monitors and reports on the user's progress towards defined financial goals.
        - Provides updates and suggestions for staying on track.
    - **Key Vertex AI Services:**
        - **Cloud Run:** Hosts the progress tracking logic.
        - **Vertex AI Generative AI Studio:** For generating encouraging updates and actionable advice.
    - **Data Sources:**
        - Internal: User financial data, defined goals (stored in Firestore).
    - **Tools/APIs:** Custom progress calculation algorithms.
    - **Configuration Notes:** Allow users to define flexible and measurable goals.

This team map provides a comprehensive blueprint for your AI agent project on Vertex AI. Remember to continuously monitor your resource usage to stay within the free-tier limits and optimize your agents for efficiency.