**Functional Specification - Wakanda Weather Monitoring System**

**Introduction**

The Functional Specification document describes the functional requirements of the Wakanda Weather Monitoring System, a weather monitoring system for the fictional nation of Wakanda. The system aims to collect, process, and provide real-time weather information.

**Functional Requirements**

**1. Satellite Registration**

The system shall allow the registration of satellites used for monitoring Wakanda's climate. Each satellite shall include the following information:

1. Satellite name.
2. Unique satellite identification.
3. Latitude and longitude coordinates of the satellite.

**2. Weather Station Registration**

The system shall allow the registration of weather stations located in different zones of Wakanda. Each weather station shall include the following information:

1. Station name.
2. Unique station identification.
3. Geographic location of the station.

**3. Real-Time Data Ingestion with Kafka**

The system shall utilize Apache Kafka for real-time data ingestion from satellites. This process shall include the following steps:

1. Satellites shall send readings as events to specific Kafka topics.
2. A Kafka consumer integrated into the weather stations shall capture these real-time events.

**4. Data Synchronization with the Database**

To maintain data persistence, the system shall implement regular synchronization of Kafka cache data with the MySQL database. This process shall include:

Creating Kafka Connect connectors to move data from the cache to the database.

Mapping Kafka events to database tables.

Synchronizing data at regular intervals to keep the database up to date.

This flow ensures that real-time weather data captured by satellites is synchronized and available for querying and analysis in the database.

**5. Processing of Readings**

The weather stations shall process the readings received from the satellites to provide weather data by zone. The processing shall include calculating the average cloud temperature, average wind speed, etc.

**6. Data Storage**

The system shall store all satellite readings and processed data in a MySQL database. Historical data shall be retained for future reference.

**7. Weather Forecast**

Based on the processed readings, the system shall provide weather forecasts for different zones of Wakanda. Forecasts shall include data such as maximum temperature, minimum temperature, precipitation, wind speed, and humidity.

**8. Endpoints Communication Using Kafka as a Service Bus**

To ensure efficient communication between different system endpoints, the system shall utilize Kafka as a service bus. This enables seamless data exchange and coordination between various components, including satellites, weather stations, and the data processing layer. Kafka topics and event-driven architecture shall facilitate this communication, allowing different components to exchange information in a decoupled manner.

**Conclusion**

This Functional Specification document highlights the essential functional requirements of the Wakanda Weather Monitoring System. The above requirements provide a solid foundation for the development and implementation of the system. It is essential for developers, testers, and other project stakeholders to be aware of these requirements to ensure that the system meets the weather monitoring needs of Wakanda.

This is a simplified example of a Functional Specification. You should customize and expand it with more details, use cases, test cases, non-functional requirements, and any other elements relevant to your project.