Technical & Vendor Documentation for Hybrid VoIP and Zero-Rated Calling Application

# 1. Introduction

This document outlines the technical requirements, vendors, APIs, and infrastructure needed to build a hybrid VoIP and zero-rated calling application. The goal of the application is to allow users to communicate through both online VoIP calls (over zero-rated or regular data) and offline calls (via carrier circuit-switched voice when the internet is unavailable).

# 2. Architecture Overview

The architecture will involve three main communication modes:  
1. \*\*Pure VoIP Calls\*\* – Uses internet-based audio streaming via WebRTC/SIP protocols.  
2. \*\*Zero-Rated VoIP Calls\*\* – Same as VoIP but with negotiated ISP zero-rating partnerships.  
3. \*\*Hybrid Carrier Bridge\*\* – When no internet or zero-rated access is available, calls fall back to carrier network using SIP trunking or PSTN gateway integration.

# 3. Vendors & APIs

## 3.1 VoIP Infrastructure Providers

- \*\*Twilio Programmable Voice\*\* – SIP trunking, PSTN bridge, and VoIP SDKs.  
- \*\*Agora.io\*\* – Low-latency audio streaming, WebRTC integration.  
- \*\*Vonage/Nexmo\*\* – WebRTC & PSTN gateway APIs.  
- \*\*SignalWire\*\* – Advanced VoIP routing and carrier-grade infrastructure.

## 3.2 Zero-Rating Partnerships

- Negotiate with ISPs such as MTN, Airtel, Glo, and 9mobile for zero-rated domains or apps.  
- Requires legal, commercial, and technical agreements.  
- Must host services in local data centers for compliance.

## 3.3 PSTN/SIP Gateways

- \*\*Twilio Elastic SIP Trunking\*\* – Bridge internet and regular phone networks.  
- \*\*Asterisk/FreeSWITCH\*\* – Open-source PBX for routing calls.  
- \*\*Plivo\*\* – Global carrier connectivity.

# 4. Technical Stack

- \*\*Frontend\*\*: React Native for cross-platform mobile app.  
- \*\*Backend\*\*: Node.js/Express for signaling, WebRTC session management.  
- \*\*Database\*\*: PostgreSQL or MongoDB for user and call records.  
- \*\*Real-time Communication\*\*: WebRTC, SIP.js, or Janus Gateway.  
- \*\*Push Notifications\*\*: Firebase Cloud Messaging (FCM) and Apple Push Notification Service (APNs).

# 5. Implementation Plan

Phase 1: Core VoIP over internet.  
Phase 2: Zero-rating negotiations and domain whitelisting.  
Phase 3: Carrier fallback using PSTN/SIP gateways.  
Phase 4: Optimization and scaling.

# 6. Compliance & Security

- Adhere to NCC telecom regulations in Nigeria.  
- Encrypt VoIP traffic using SRTP/TLS.  
- Comply with ISP legal requirements for zero-rating.  
- Implement anti-fraud measures for call routing.