Private Chat & Calls Phase 2

Production Architecture

NexGate / QBIT SPARK | Version 1.0 *Ejabberd · WebRTC Calls · Voice & Video · MessagePack · Coturn · Message Interactions*

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1. NexGate Chat Roadmap

Before any code is written — understand the full journey. Three stages. Each builds on the previous.

Stage 1 — Local Experiments (Terminal Only, No Coding)

```
  Goal:     understand the tools before building with them
  Duration: 1 week
  Output:   confidence, not code
  Method:   terminal only — Docker CLI, curl, sendxmpp
            NO Android app
            NO Android Studio
            NO Java project
            NO NexGate codebase

  Everything in this stage is throwaway
  Run it locally on your Xubuntu machine
  No production VPS involved
```

Tools to Install First

```
  # XMPP CLI client
  sudo apt install sendxmpp

  # WebSocket CLI client
  wget https://github.com/vi/websocat/releases/download/v1.12.0/websocat.x86_64-unknown-linux-musl
  chmod +x websocat.x86_64-unknown-linux-musl
  sudo mv websocat.x86_64-unknown-linux-musl /usr/local/bin/websocat

  # STUN test client
  sudo apt install stuntman-client

  # Network packet inspection
  sudo apt install tcpdump
```

```
# Python + MessagePack (for experiment 7)
pip3 install msgpack --break-system-packages

# curl and docker — already installed 
```

Experiment 1 — Ejabberd Running Locally

```
Goal: get Ejabberd running, send one message via terminal
Success: message delivered, logs confirm routing
```

```
# Start Ejabberd
docker run -d \
  --name ejabberd \
  -p 5222:5222 \
  -p 5280:5280 \
  -p 5285:5285 \
  ghcr.io/processone/ejabberd

# Wait for startup
sleep 15

# Check it's running
docker exec ejabberd ejabberdctl status
# Expected: Node ejabberd@localhost is started

# Create two test users
docker exec ejabberd ejabberdctl register alice nexgate.com password123
docker exec ejabberd ejabberdctl register bob nexgate.com password123

# Verify users exist
docker exec ejabberd ejabberdctl registered_users nexgate.com
# Expected output:
# alice
# bob

# Send message alice → bob (no app needed!)
docker exec ejabberd ejabberdctl send_message \
  chat alice@nexgate.com bob@nexgate.com \
  "" "Habari Bob! Kutoka terminal"
```

```
# Watch Ejabberd logs — see message routing
docker logs ejabberd --tail 30

# Open dashboard in browser
# http://localhost:5280/admin
# admin / password (default)
# See users, sessions, statistics
```

```
What you learn:
  How Ejabberd starts and configures
  ejabberdctl is your management CLI
  Messages route without any app
  Dashboard shows what's happening
  Logs show every routing decision
```

Experiment 2 — REST API (How Spring Boot Will Talk to Ejabberd)

```
Goal: talk to Ejabberd via HTTP — same way Spring Boot will
Success: curl commands work, responses received
```

```
# Send message via REST API (this is exactly what Spring Boot does)
curl -s -X POST http://localhost:5285/api/send_message \
  -H "Content-Type: application/json" \
  -d '{
    "from": "alice@nexgate.com",
    "to": "bob@nexgate.com",
    "body": "Kutoka curl — kama Spring Boot!"
  }' | python3 -m json.tool

# Get all connected users
curl -s -X POST http://localhost:5285/api/connected_users \
  -H "Content-Type: application/json" \
  -d '{}' | python3 -m json.tool

# Get registered users
curl -s -X POST http://localhost:5285/api/registered_users \
  -H "Content-Type: application/json" \
  -d '{"host": "nexgate.com"}' | python3 -m json.tool
```

```
# Create a MUC group chat room
curl -s -X POST http://localhost:5285/api/create_room \
  -H "Content-Type: application/json" \
  -d '{
    "name": "nexgate-test-room",
    "service": "conference.nexgate.com",
    "host": "nexgate.com"
  }' | python3 -m json.tool

# List active MUC rooms
curl -s -X POST http://localhost:5285/api/muc_online_rooms \
  -H "Content-Type: application/json" \
  -d '{"service": "conference.nexgate.com"}' | python3 -m json.tool

# Kick a user session
curl -s -X POST http://localhost:5285/api/kick_session \
  -H "Content-Type: application/json" \
  -d '{
    "user": "alice",
    "host": "nexgate.com",
    "resource": "test",
    "reason": "Test kick"
  }' | python3 -m json.tool
```

```
What you learn:
  Every curl call = what Spring Boot RestTemplate does
  REST API is how NexGate backend controls Ejabberd
  Port 5285 = admin API (internal only in production)
  All operations possible without any mobile app
```

Experiment 3 — sendxmpp (Connect as XMPP User)

```
Goal: connect as a real XMPP user from terminal
Success: send/receive messages between two terminal sessions
```

```
# Terminal 1 — send message as alice
echo "Habari Bob! Ninatuma kutoka terminal" | sendxmpp \
  --username alice \
```

```
  --password password123 \
  --host localhost \
  --port 5222 \
  --domain nexgate.com \
  --tls-ca-path /dev/null \
  --insecure \
  bob@nexgate.com

# Watch Ejabberd logs in another terminal:
docker logs ejabberd -f

# See stanzas flowing in logs:
# Received message from alice@nexgate.com
# Routing to bob@nexgate.com
# Delivered □

# Send typing indicator (composing stanza)
# sendxmpp handles this via --chat-state flag
echo "Ninaandika..." | sendxmpp \
  --username alice \
  --password password123 \
  --host localhost \
  --port 5222 \
  --domain nexgate.com \
  --insecure \
  --chat-state \
  bob@nexgate.com
```

```
What you learn:
  XMPP login flow from client perspective
  Stanza routing in Ejabberd logs
  How typing indicators flow
  What mobile app will do — terminal does it first
```

Experiment 4 — Watch Raw XMPP Stanzas

```
Goal: see actual XML stanzas flowing over the wire
Success: raw XMPP XML visible in terminal
```

```
# Terminal 1 — watch all XMPP traffic
sudo tcpdump -i lo -A port 5222 2>/dev/null | grep -A5 "<message\|<presence\|<iq"

# Terminal 2 — connect via websocat (WebSocket)
websocat ws://localhost:5280/ws

# Type this in websocat terminal:
# (open XMPP stream)

# Terminal 3 — send message via sendxmpp
echo "Test stanza" | sendxmpp \
  --username alice \
  --password password123 \
  --host localhost \
  --domain nexgate.com \
  --insecure \
  bob@nexgate.com

# Watch Terminal 1 — see raw XML:
# <message from='alice@nexgate.com'
#          to='bob@nexgate.com'
#          type='chat'>
#   <body>Test stanza</body>
# </message>
```

```
What you learn:
  What XMPP stanzas actually look like on wire
  Difference between connection, auth, message stanzas
  How namespaces appear in real traffic
  Visual confirmation of everything in the docs
```

Experiment 5 — Spring Boot Auth Bridge

```
Goal: Ejabberd calls Spring Boot to validate users
Success: Spring Boot approves/rejects Ejabberd connections
Note: minimal Spring Boot — one endpoint only, H2 in-memory DB
```

```
# Step 1: Create minimal Spring Boot project
# ONE controller, ONE endpoint only:
```

```
# POST /internal/ejabberd/auth
# Body: { "user": "alice", "host": "nexgate.com", "pass": "password123" }
# Returns: 200 (allow) or 401 (deny)

# Step 2: Run Spring Boot on port 8080
./mvnw spring-boot:run

# Step 3: Configure Ejabberd to call Spring Boot
# Create ejabberd.yml with:
#   auth_method: http
#   auth_opts:
#     url: "http://host.docker.internal:8080/internal/ejabberd/auth"

# Restart Ejabberd with custom config
docker stop ejabberd && docker rm ejabberd
docker run -d \
  --name ejabberd \
  -p 5222:5222 \
  -p 5280:5280 \
  -p 5285:5285 \
  -v $(pwd)/ejabberd.yml:/home/ejabberd/conf/ejabberd.yml \
  ghcr.io/processone/ejabberd

# Step 4: Test auth via sendxmpp
echo "Test" | sendxmpp \
  --username alice \
  --password password123 \
  --host localhost \
  --domain nexgate.com \
  --insecure \
  bob@nexgate.com

# Watch Spring Boot logs:
# "Auth request received: alice@nexgate.com"
# "Validated: allowed □"

# Try wrong password
echo "Test" | sendxmpp \
  --username alice \
  --password WRONG \
```

```
  --host localhost \
  --domain nexgate.com \
  --insecure \
  bob@nexgate.com

# Spring Boot logs:
# "Auth request received: alice@nexgate.com"
# "Invalid credentials: rejected □"
# Ejabberd logs: "Authentication failed"
```

```
What you learn:
  Auth bridge works exactly as designed
  Spring Boot is the source of truth for auth
  Ejabberd trusts Spring Boot completely
  This is the same bridge NexGate will use
  Response time matters — must be < 200ms
```

Experiment 6 — Two Node Cluster + Erlang Dist

```
Goal: two Ejabberd nodes talking via Erlang distribution
Success: message sent on node1 arrives at user on node2
```

```
# Create Docker network for the cluster
docker network create ejabberd-cluster

# Start node 1
docker run -d \
  --name ejabberd-node1 \
  --hostname ejabberd-node1 \
  --network ejabberd-cluster \
  -e ERLANG_NODE=ejabberd@ejabberd-node1 \
  -e ERLANG_COOKIE=nexgate_secret_cookie \
  -p 5222:5222 \
  -p 5280:5280 \
  -p 5285:5285 \
  ghcr.io/processone/ejabberd

sleep 15
```

```
# Start node 2
docker run -d \
  --name ejabberd-node2 \
  --hostname ejabberd-node2 \
  --network ejabberd-cluster \
  -e ERLANG_NODE=ejabberd@ejabberd-node2 \
  -e ERLANG_COOKIE=nexgate_secret_cookie \
  -p 5223:5222 \
  -p 5281:5280 \
  -p 5286:5285 \
  ghcr.io/processone/ejabberd

sleep 10

# Join node2 to node1 cluster
docker exec ejabberd-node2 \
  ejabberdctl join_cluster ejabberd@ejabberd-node1

# Verify cluster is formed
docker exec ejabberd-node1 ejabberdctl list_cluster
# Expected:
# ejabberd@ejabberd-node1
# ejabberd@ejabberd-node2  □

# Register alice on node1
docker exec ejabberd-node1 \
  ejabberdctl register alice nexgate.com pass123

# Register bob on node2
docker exec ejabberd-node2 \
  ejabberdctl register bob nexgate.com pass123

# Send message FROM node1 TO bob (who is on node2)
docker exec ejabberd-node1 ejabberdctl send_message \
  chat alice@nexgate.com bob@nexgate.com \
  "" "Cross-node via Erlang dist!"

# Check node2 logs — message arrived from node1
docker logs ejabberd-node2 --tail 20
# See: message routed from ejabberd@ejabberd-node1 □
```

```
# Verify cluster health
docker exec ejabberd-node1 ejabberdctl mnesia_info | grep running_db_nodes
# Shows both nodes sharing Mnesia DB □
```

```
What you learn:
  Erlang dist routing works across containers
  Same cookie = trusted cluster
  No Redis pub/sub needed for cross-node routing
  Mnesia shared across nodes automatically
  This is production-ready cluster behavior
```

Experiment 7 — RabbitMQ Events from Ejabberd

```
Goal: Ejabberd publishes events to RabbitMQ, read them in terminal
Success: see chat events flowing to RabbitMQ queues
```

```
# Ensure RabbitMQ is running (already in your stack)
docker ps | grep rabbit

# Configure Ejabberd to publish to RabbitMQ
# Add to ejabberd.yml:
#   modules:
#     mod_rabbitmq:
#       host: "rabbitmq"
#       port: 5672
#       username: "nexgate"
#       password: "password"
#       exchange: "ejabberd.events"

# Create the exchange in RabbitMQ
docker exec rabbitmq rabbitmqadmin declare exchange \
  name=ejabberd.events \
  type=topic \
  durable=true

# Create queue and binding
docker exec rabbitmq rabbitmqadmin declare queue \
  name=chat.message.inbound \
```

```
  durable=true

docker exec rabbitmq rabbitmqadmin declare binding \
  source=ejabberd.events \
  destination=chat.message.inbound \
  routing_key=chat.message.inbound

# Send a message via ejabberdctl
docker exec ejabberd ejabberdctl send_message \
  chat alice@nexgate.com bob@nexgate.com \
  "" "This should appear in RabbitMQ!"

# Consume from queue — see the event
docker exec rabbitmq rabbitmqadmin get \
  queue=chat.message.inbound \
  ackmode=ack_requeue_false

# Watch queue depth in real time
watch -n 1 'docker exec rabbitmq rabbitmqctl list_queues name messages'

# Open RabbitMQ dashboard
# http://localhost:15672
# See exchanges, queues, message rates 
```

```
What you learn:
  Ejabberd → RabbitMQ event pipeline works
  Event payload structure
  Queue depth monitoring
  This is exactly how Spring Boot Chat Service
  will receive Ejabberd events in production
```

Experiment 8 — Coturn STUN/TURN

```
Goal: TURN relay server running, STUN tested from terminal
Success: STUN returns public IP, relay connection established
```

```
# Start Coturn
docker run -d \
  --name coturn \
```

```
  --network host \
  coturn/coturn \
  -n \
  --log-file=stdout \
  --min-port=49152 \
  --max-port=65535 \
  --lt-cred-mech \
  --user=nexgate:testpassword \
  --realm=nexgate.com

# Test STUN from terminal
stunclient localhost 3478
# Expected output:
# Binding test: success
# Local address: 127.0.0.1:XXXXX
# Mapped address: 127.0.0.1:XXXXX  □

# Watch Coturn logs
docker logs coturn -f
# See STUN requests arriving and responses □

# Test WebRTC in browser (no Android needed!)
# Open this URL in two browser tabs:
# https://webrtc.github.io/samples/src/content/peerconnection/pc1/
# Configure TURN server: localhost:3478
# Credentials: nexgate / testpassword
# Force TURN (disable direct connections in browser devtools)
# Establish audio connection between tabs
# Watch Coturn logs — see relay traffic □
```

```
What you learn:
  Coturn starts and runs correctly
  STUN works (public IP discovery)
  TURN relay works (audio through server)
  EA carrier NAT bypass confirmed
  Browser tabs = simpler than Android emulators
```

Experiment 9 — MessagePack Size Comparison

```
  Goal: prove MessagePack saves 60% vs JSON on EA networks
  Success: numbers printed, saving confirmed
```

```
  # Create test script
  cat > /tmp/test_msgpack.py << 'EOF'
import json
import msgpack

# Real NexGate chat message
message = {
    "type": "MSG_SEND",
    "conv_id": "conv-123456789",
    "sender_id": "usr-987654321",
    "body": "Habari yako Juma, vipi biashara leo?",
    "timestamp": 1719446400000,
    "temp_id": "abc-def-ghi-jkl-mno",
    "level": "NORMAL",
    "content_type": "TEXT"
}

# Commerce offer stanza metadata
offer_message = {
    "type": "CUSTOM_PRICE_OFFER",
    "conv_id": "conv-123456789",
    "offer_id": "offer-uuid-abc-def",
    "product_id": "prod-samsung-a15",
    "public_price": 450000,
    "offer_price": 400000,
    "currency": "TZS",
    "valid_minutes": 30
}

print("=" * 50)
print("NEXGATE MESSAGE SIZE COMPARISON")
print("=" * 50)

for name, msg in [("Text message", message), ("Offer message", offer_message)]:
    json_bytes = json.dumps(msg).encode()
    msgpack_bytes = msgpack.packb(msg)
    reduction = round((1 - len(msgpack_bytes)/len(json_bytes)) * 100)
```

```
    print(f"\n{name}:")
    print(f"  JSON:        {len(json_bytes)} bytes")
    print(f"  MessagePack: {len(msgpack_bytes)} bytes")
    print(f"  Saving:      {reduction}% smaller")

# Daily usage estimate
print("\n" + "=" * 50)
print("EA DATA BUNDLE IMPACT (1000 messages/day)")
print("=" * 50)
avg_json = 160
avg_msgpack = 60
print(f"  JSON:        {avg_json * 1000 / 1024:.0f} KB/day")
print(f"  MessagePack: {avg_msgpack * 1000 / 1024:.0f} KB/day")
print(f"  Saving:      {(avg_json - avg_msgpack) * 1000 / 1024:.0f} KB/day per user")
print(f"               ~{(avg_json - avg_msgpack) * 1000 * 30 / 1024 / 1024:.1f} MB saved per
month")
EOF

  python3 /tmp/test_msgpack.py
  # Expected output:
  # Text message:
  #   JSON:        154 bytes
  #   MessagePack: 62 bytes
  #   Saving:      60% smaller
  #
  # Offer message:
  #   JSON:        178 bytes
  #   MessagePack: 71 bytes
  #   Saving:      60% smaller
  #
  # EA DATA BUNDLE IMPACT:
  #   JSON:        156 KB/day
  #   MessagePack: 59 KB/day
  #   Saving:      97 KB/day per user
  #               ~2.8 MB saved per month 
```

```
  What you learn:
    Real numbers — not estimates
    60% confirmed on NexGate-specific messages
    Monthly saving per EA user calculated
```

```
  Justifies the MessagePack implementation effort
```

Experiment Success Checklist

```
Before moving to Stage 2 (building NexGate):
All 9 must be green □

Exp 1  Ejabberd running locally              □ / □
Exp 2  REST API working via curl             □ / □
Exp 3  sendxmpp connects as XMPP user        □ / □
Exp 4  Raw XMPP stanzas visible in tcpdump   □ / □
Exp 5  Spring Boot auth bridge working       □ / □
Exp 6  Two node cluster + Erlang dist        □ / □
Exp 7  RabbitMQ events from Ejabberd         □ / □
Exp 8  Coturn STUN/TURN + browser WebRTC     □ / □
Exp 9  MessagePack saving confirmed          □ / □

All green → Stage 2 starts
Any red   → fix it before moving forward
            surprises in experiments = learning
            surprises in production = problems
```

Stage 2 — Build NexGate Chat Phase 2

```
Goal:     production-ready chat on NexGate
Duration: ~16 weeks
Output:   WhatsApp-class chat shipped to EA users

Start coding HERE — not before
Every experiment above maps to real code:
  Exp 1 → Ejabberd Docker in production compose
  Exp 2 → Spring Boot EjabberdClient (curl → RestTemplate)
  Exp 3 → Mobile app XMPP connection (sendxmpp → Smack SDK)
  Exp 5 → Real auth bridge with JWT validation
  Exp 6 → Two node cluster on Hetzner VPS
  Exp 7 → RabbitMQ consumers in Chat Service
  Exp 8 → Coturn on separate Hetzner CX11
```

```
  Exp 9 → MessagePack in NexGate Chat SDK

16-week build order in Section 19

What ships:
  Text chat (1:1 + group)
  Voice notes
  Voice + video calls (+ switch audio↔video)
  Screen sharing
  Group calls (LiveKit)
  Commerce DMs (both flows)
  Offer sessions (full lifecycle)
  Message interactions (edit/delete/react/forward)
  Shop inbox with staff access
  Offline delivery + FCM + Textfy
  EA network optimized (Coturn + Opus + H.264)
  WhatsApp-class infrastructure
  Commerce-aware from day one

Infrastructure:
  Ejabberd cluster (2 nodes, same VPS)
  Coturn (separate Hetzner CX11 ~€4/month)
  Spring Boot Chat Service (new microservice)
  All existing infra (Redis, RabbitMQ, PostgreSQL)
  File Thunder (already running) 
```

Stage 3 — Eventually (WeChat EA)

```
Goal:     full super app communication platform
Timeline: after Phase 2 is live and growing

VP Live (Video Streaming):
  SRS Media Server
  RTMP ingest → HLS → Cloudflare CDN
  Live comments (Ejabberd MUC)
  VOD after stream (File Thunder)

VP Audio Spaces:
```

```
  LiveKit SFU
  Multi-speaker rooms (Twitter Spaces model)
  Radio mode (one broadcaster → millions)
  Raise hand system

Group Calls:
  LiveKit already deployed for Audio Spaces
  Activate for group voice + video
  Up to 8 participants voice (3G compatible)
  Up to 4 video feeds simultaneously

Mini Apps (MQTT):
  Ejabberd MQTT broker (already in Ejabberd config)
  Third-party apps subscribe to events
  JikoXpress integration
  Real-time order tracking
  NexGate developer platform

WeChat EA:
  All of the above live
  NexGate = EA's daily life infrastructure
  Every transaction has a conversation
  Every conversation can become a transaction □□
```

The Progression

NOW	THEN	EVENTUALLY
Terminal only	NexGate chat live	VP Live streaming
Docker CLI	Text + calls	VP Audio Spaces
curl + sendxmpp	Commerce DMs	Group calls
ejabberdctl	Offer sessions	Mini Apps (MQTT)
tcpdump + wireshark	Shop inbox + staff	NexGate developer
9 experiments	16 weeks to ship	platform
No app built yet	WhatsApp-class	WeChat EA vision
Confidence	Product	Platform

---

2. What Is Phase 2

NexGate chat is built directly on Phase 2 architecture from scratch. There is no Phase 1 to migrate from. No Spring Boot WebSocket gateway was ever built. No Redis pub/sub routing to replace.

Phase 2 is the starting point — not an upgrade.

```
Why start directly on Phase 2:

Ejabberd handles 2M concurrent connections
  Spring Boot WS would need many pods to reach this
  Ejabberd does it on two Docker containers

Voice + video calls needed from launch
  Ejabberd Jingle (XEP-0166) solves signaling natively
  Building WebRTC signaling from scratch = months wasted

25+ chat features free from Ejabberd XEPs
  Typing indicators, delivery ticks, read receipts,
  multi-device sync, message archive, push bridge
  All zero custom code — just Ejabberd config

EA network demands carrier-grade infrastructure
  Stream Management (XEP-0198) = no message loss on 2G
  Cannot afford to rebuild this later

Commerce-aware chat from day one
  Custom XMPP namespaces for product cards,
  offer sessions, event cards, group purchases
  Ejabberd routes them — Spring Boot handles business logic
```

NexGate chat is a greenfield Phase 2 build.

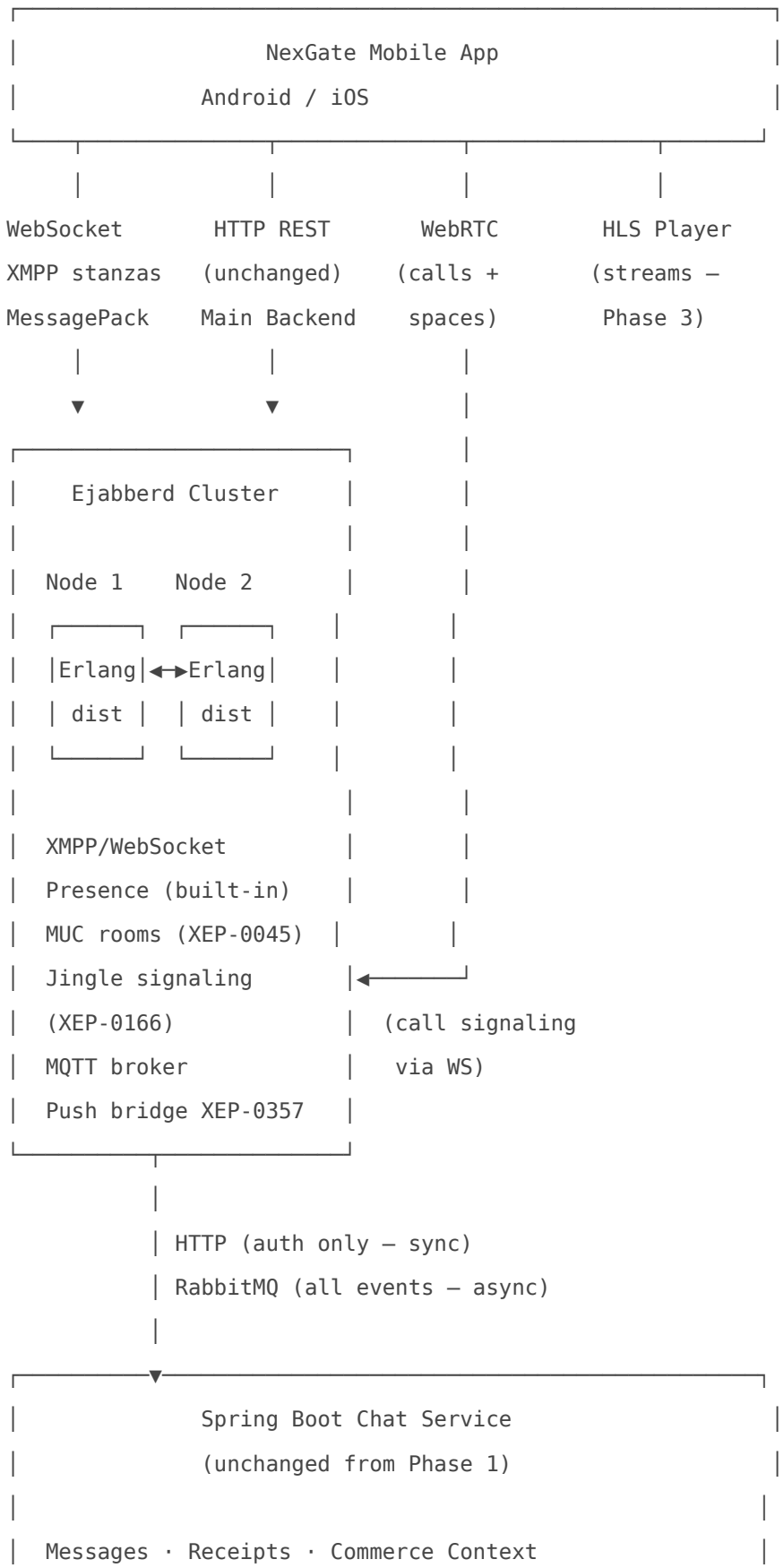
---

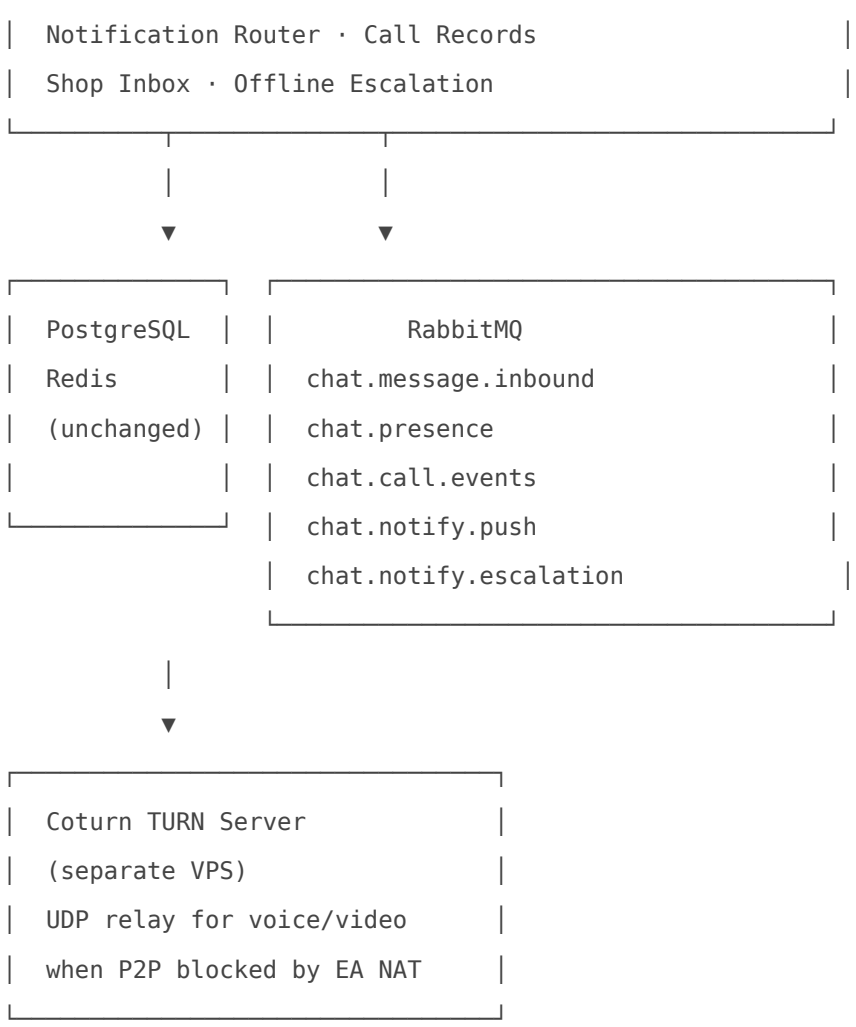
3. What We Are Building

```
Building from scratch:

Ejabberd Cluster         ← real-time transport
```

```
  Two nodes, same Hetzner VPS at launch
  Handles all WebSocket connections
  Routes all XMPP stanzas
  Manages presence, MUC, Jingle calls
  XEP-0198 stream management for EA networks

Spring Boot Chat Service  ← business brain
  Message persistence (PostgreSQL)
  Commerce context (offer sessions, product cards)
  Notification routing (FCM + Textfy)
  Shop inbox access control
  Call records + quality logs
  Offline escalation

Spring Boot Main Backend  ← platform API
  Auth (PONA Auth V3) + XMPP token issuance
  VP Shop, VP Feed, VP Events integration
  Commerce triggers to Chat Service

Coturn TURN Server        ← voice/video relay
  EA carrier NAT bypass
  Separate small Hetzner VPS

NexGate Chat SDK          ← mobile dev layer
  Android (Smack wrapper)
  iOS (XMPPFramework wrapper)
  Hides all XMPP complexity from mobile dev
  Clean Java/Swift API

Infrastructure (already running):
  Redis       □ presence cache, hot messages
  RabbitMQ    □ offline queue, service events
  PostgreSQL  □ persistence
  MinIO       □ media storage
  Cloudflare  □ CDN
  Vault       □ secrets
  Traefik     □ reverse proxy
  File Thunder □ media processing
  FCM + Textfy □ notifications
```

4. Full Architecture





---

5. Ejabberd — The Transport Backbone

What Ejabberd Owns in Phase 2

```
✅ All WebSocket connections (2M concurrent per node)
✅ XMPP stanza routing between users
✅ User presence — online/offline/away (built-in protocol)
✅ Typing indicators (XEP-0085)
✅ Message delivery receipts (XEP-0184)
✅ Multi-User Chat rooms — MUC (XEP-0045)
✅ Voice/video call signaling — Jingle (XEP-0166)
✅ Push notification bridge (XEP-0357 → FCM/APNs)
✅ MQTT broker (Mini Apps events)
✅ Stream management / reconnection (XEP-0198)
✅ Cross-node routing (Erlang distributed — no Redis pub/sub needed)
```

```
 Does NOT touch:
   PostgreSQL (NexGate's schema)
   Business logic
   Commerce context
   Payment processing
   File processing
```

Ejabberd Key Modules Enabled

```
mod_mam          Message Archive Management
                 Stores message history in its own DB
                 Clients can sync history on reconnect

mod_muc          Multi-User Chat
                 Group chats, live stream comment rooms
                 Max 500 members per room (configurable)
                 Persistent rooms survive server restart

mod_ping         Keepalive ping every 30 seconds
                 Kills dead connections automatically
                 Critical for EA mobile networks

mod_push         Push notification bridge
                 Connects to FCM/APNs on user disconnect
                 Replaces manual FCM calls from Chat Service

mod_stun_disco   STUN/TURN server discovery
                 Tells clients where Coturn is
                 Used for voice/video call setup

mod_mqtt         MQTT broker on port 1883
                 For Mini Apps real-time events (Phase 3)
                 Zero extra infrastructure needed

mod_http_api     REST API on port 5285
                 Spring Boot calls this to send messages
                 Admin operations (kick user, create room)
```

Ejabberd Config Highlights

```
hosts:
  - "nexgate.com"

listen:
  - port: 5280          # WebSocket — mobile app connects here
    module: ejabberd_http
    request_handlers:
      /ws: ejabberd_ws
      /api: mod_http_api

  - port: 5285          # REST API — Spring Boot calls here (internal only)
    module: ejabberd_http
    ip: "127.0.0.1"
    request_handlers:
      /api: mod_http_api

  - port: 1883          # MQTT — Mini Apps (Phase 3)
    module: mod_mqtt

  - port: 3478          # STUN — voice/video setup
    transport: udp
    module: ejabberd_stun

# Auth — Ejabberd calls Spring Boot
auth_method: http
auth_opts:
  url: "http://chat-service:8082/internal/ejabberd/auth"
  auth_header: "X-Internal-Secret"
  auth_header_value: "${EJABBERD_INTERNAL_SECRET}"

# PostgreSQL — Ejabberd's own separate database
sql_type: pgsql
sql_server: "postgres"
sql_database: "ejabberd"    # NOT nexgate — separate DB
default_db: sql

modules:
```

```
  mod_mam:
    default: always
    db_type: sql
  mod_muc:
    db_type: sql
    max_users: 500
  mod_ping:
    send_pings: true
    ping_interval: 30
    timeout_action: kill
  mod_push: {}
  mod_stun_disco:
    credentials_lifetime: 3600
    services:
      - host: "turn.nexgate.com"
        port: 3478
        type: turn
        secret: "${COTURN_SECRET}"
  mod_mqtt: {}
  mod_http_api: {}
```

Two Separate PostgreSQL Databases

```
postgres instance (same server, two databases):

nexgate    ← NexGate application data
             messages, conversations, users, orders
             Spring Boot owns this entirely
             Ejabberd never touches this

ejabberd   ← Ejabberd's own operational data
             message archive (MAM)
             MUC room state
             roster data
             Spring Boot never touches this

Why separate:
  Ejabberd manages its own schema migrations
  NexGate schema evolves independently
```

```
  Clean ownership — no shared tables
  Easy to backup independently
```

---

6. Ejabberd ? Spring Boot Bridge

Communication Rules

```
Ejabberd → Spring Boot:

  Auth events:      HTTP (synchronous — must respond fast)
  Message events:   RabbitMQ (async)
  Presence events:  RabbitMQ (async)
  Call events:      RabbitMQ (async)
  MUC events:       RabbitMQ (async)

Spring Boot → Ejabberd:

  Send message to user:     Ejabberd REST API (port 5285)
  Create MUC room:          Ejabberd REST API
  Kick user session:        Ejabberd REST API
  Check user online:        Ejabberd REST API
  Broadcast to room:        Ejabberd REST API

Rule: auth is the ONLY synchronous call
      Everything else is async via RabbitMQ
```

RabbitMQ Events from Ejabberd

```
Exchange: ejabberd.events (topic)

Routing Key                  Fired When
──────────────────────────────────────────────────────
chat.message.inbound         User sends a message
chat.message.group           User sends to MUC room
chat.presence.online         User WS connects
chat.presence.offline        User WS disconnects
```

```
chat.call.initiated          Jingle session-initiate received
chat.call.accepted           Jingle session-accept received
chat.call.declined           Jingle session-declined received
chat.call.ended              Jingle session-terminate received
chat.muc.created             MUC room created
chat.muc.joined              User joined MUC room
chat.muc.left                User left MUC room
```

Spring Boot Internal Endpoints (Ejabberd calls these)

```
POST /internal/ejabberd/auth
  Called on every WebSocket connection
  Ejabberd sends: { username, token }
  Spring Boot responds: 200 (allow) or 401 (deny)
  Must respond in < 200ms (checked in Redis cache first)

All other events arrive via RabbitMQ consumers
No other synchronous HTTP endpoints needed
```

Spring Boot ? Ejabberd REST API Examples

```
Send system message to user:
POST http://ejabberd:5285/api/send_message
{
  "from": "system@nexgate.com",
  "to":   "usr-123@nexgate.com",
  "body": "",
  "extra": {
    "type": "ORDER_STATUS_UPDATE",
    "orderId": "ord-456",
    "status": "SHIPPED"
  }
}

Create live stream MUC room:
POST http://ejabberd:5285/api/create_room
{
```

```
  "name":    "live-stream-abc",
  "service": "conference.nexgate.com",
  "host":    "nexgate.com"
}

Kick expired session:
POST http://ejabberd:5285/api/kick_session
{
  "user":     "usr-123",
  "host":     "nexgate.com",
  "resource": "android",
  "reason":   "Token expired"
}
```

---

7. Authentication Flow

Two Tokens Issued at Login

```
User logs into NexGate
     |
     ▼ POST /auth/login
Main Backend (PONA Auth V3):
  Validate credentials
  Issue two tokens:

  REST JWT (7 days):
    Used for all HTTP API calls
    Standard Bearer token

  XMPP Token (24 hours):
    Used only for Ejabberd connection
    Contains: userId, JID, expiry
    Shorter lifetime — chat sessions refresh more often
     |
     ▼ Both tokens returned to app
```

WebSocket Connection Auth

```
App connects WebSocket:
wss://chat.nexgate.com/ws
Header: Authorization: Bearer {XMPP_TOKEN}
     |
     ▼
Ejabberd receives connection
Extracts token from header
     |
     ▼ HTTP POST (sync) → Spring Boot
/internal/ejabberd/auth
{ username: "usr-123", token: "XMPP_TOKEN" }
     |
Spring Boot:
  Check Redis cache first (fast path):
    token:{hash} → valid/invalid (TTL 5min)
  If not cached:
    Validate JWT signature
    Check token type == XMPP
    Check user not banned/suspended
    Cache result in Redis
  Return: 200 { authorized: true, jid: "usr-123@nexgate.com" }
       or 401 { authorized: false, reason: "TOKEN_EXPIRED" }
     |
Ejabberd:
  200 → allow connection
        register: usr-123@nexgate.com/android as ONLINE
        publish to RabbitMQ: chat.presence.online
  401 → reject WebSocket
        app shows: "Session expired, please login again"
```

JID Structure

```
Every NexGate entity has a JID (Jabber ID):

Personal user:
  usr-123@nexgate.com/android     ← full JID (user + device)
  usr-123@nexgate.com             ← bare JID (user only)

Shop identity:
```

```
  techstore@shops.nexgate.com     ← shop JID
  Multiple staff auth as this JID
  Customer sees "TechStore" — not the staff member

System bot:
  system@nexgate.com              ← order updates, notifications

MUC rooms:
  live-abc@conference.nexgate.com ← live stream chat room
  group-xyz@conference.nexgate.com ← group chat room

Multi-device:
  usr-123@nexgate.com/android     ← phone
  usr-123@nexgate.com/ios         ← tablet
  Both receive messages
  READ on one → Ejabberd notifies other to clear notification
```

XMPP Token Refresh

```
XMPP token expires every 24 hours

App background service:
  At 23 hours → POST /auth/refresh-xmpp-token
  Header: Bearer {REST_JWT}  (still valid — 7 days)
  Response: new XMPP token

Re-auth without reconnecting:
  App sends new auth stanza on existing WS connection
  Ejabberd re-validates via Spring Boot
  No disconnection — seamless for user
```

---

8. Message Flow — Phase 2

Inbound Message (User Sends)

```
[Client A — Android]
     │
     │ WebSocket frame (MessagePack encoded):
     │ {
     │   type: MSG_SEND
     │   temp_id: "abc-123"
     │   to: "usr-456@nexgate.com"
     │   conv_id: "conv-789"
     │   body: "Habari"
     │   content_type: TEXT
     │ }
     │
     ▼
[Ejabberd Node 1]
     │
     ├── Validates session (already authed)
     ├── ACKs client immediately:
     │     { temp_id: "abc-123", status: ACK }
     ├── Routes to usr-456 (if online):
     │     Erlang looks up which node holds usr-456
     │     If Node 1 → delivers directly
     │     If Node 2 → Erlang distributed message (no Redis needed)
     │
     └── Publishes to RabbitMQ: chat.message.inbound
           {
             from: "usr-123@nexgate.com",
             to: "usr-456@nexgate.com",
             conv_id: "conv-789",
             body: "Habari",
             temp_id: "abc-123",
             timestamp: 1719446400
           }
     .
     . (async)
     .
[Spring Boot Chat Service]
     │ consumes chat.message.inbound
     │
     ├── Authorization check (can A message B?)
```

```
      ├── Resolve message level
      ├── Write to PostgreSQL (messages table)
      ├── Write to Redis hot cache (last 50 per conv)
      ├── Update conversation last_message
      │
      ├── usr-456 online? (check via Ejabberd REST API)
      │     YES → DELIVERED receipt after Ejabberd confirms
      │     NO  → RabbitMQ offline queue + FCM + escalation timer
      │
      └── Notify sender: tick update
            REST API → Ejabberd → WS push to Client A
            Client A: ✓✓ (delivered)
```

Cross-Node Routing — No Redis Pub/Sub Needed

```
Phase 1 (Spring Boot WS):
  Pod 1 holds Client A connection
  Pod 2 holds Client B connection
  Redis pub/sub needed to bridge pods
  Pod 1 publishes → Redis → Pod 2 delivers

Phase 2 (Ejabberd cluster):
  Node 1 holds Client A connection
  Node 2 holds Client B connection
  Erlang distributed messaging bridges nodes
  Node 1 → Erlang dist → Node 2 delivers
  Redis pub/sub no longer needed for routing
  (Redis still used by Chat Service for hot cache)

This is why Ejabberd can do 2M concurrent:
  Erlang process per connection (~2KB RAM each)
  Native cross-node routing built into the language
  No external message bus overhead
```

---

9. Voice Calls

Components

```
Signaling:    Ejabberd Jingle (XEP-0166)
              coordinates call setup via XMPP stanzas

STUN:         Ejabberd built-in (mod_stun_disco)
              helps devices find their public IP behind NAT

TURN:         Coturn (separate VPS)
              relay when P2P impossible (EA carrier NAT)

Transport:    WebRTC in mobile app
              actual audio stream between devices

Codec:        Opus
              adaptive 6kbps (2G) → 64kbps (WiFi)
              echo cancellation + noise suppression built in
              non-negotiable for EA networks
```

Jingle Signaling Stanzas

```
<!-- Step 1: Kibuti initiates call to Juma -->
<iq from="kibuti@nexgate.com/android"
    to="juma@nexgate.com"
    type="set" id="call-001">
  <jingle xmlns="urn:xmpp:jingle:1"
          action="session-initiate"
          sid="session-abc-123"
          initiator="kibuti@nexgate.com/android">
    <content name="audio">
      <description xmlns="urn:xmpp:jingle:apps:rtp:1"
                   media="audio">
        <payload-type id="111" name="opus" clockrate="48000"/>
      </description>
      <transport xmlns="urn:xmpp:jingle:transports:ice-udp:1"
                 ufrag="someUfrag"
                 pwd="somePassword">
        <candidate ... />  <!-- Kibuti's ICE candidates -->
```

```
      </transport>
    </content>
  </jingle>
</iq>

<!-- Step 2: Juma accepts -->
<iq from="juma@nexgate.com/android"
    to="kibuti@nexgate.com/android"
    type="set" id="call-002">
  <jingle action="session-accept"
          sid="session-abc-123">
    <!-- Juma's SDP answer + ICE candidates -->
  </jingle>
</iq>

<!-- Step 3: Call ends -->
<iq type="set">
  <jingle action="session-terminate"
          sid="session-abc-123">
    <reason><success/></reason>
  </jingle>
</iq>
```

Full Voice Call Flow

```
[Kibuti — taps Call]
     |
     ▼ GET /chat/calls/turn-credentials
Spring Boot returns:
{
  iceServers: [
    { urls: "stun:chat.nexgate.com:3478" },
    { urls: "turn:turn.nexgate.com:3478",
      username: "usr-123:1719446400",
      credential: "hmac_token" }
  ],
  ttl: 3600
}
     |
```

```
     ▼ Initialize WebRTC PeerConnection
Add audio track (Opus codec)
Gather ICE candidates (STUN discovery)
     │
     ▼ Send Jingle session-initiate via Ejabberd WS
Ejabberd routes to Juma
Ejabberd fires RabbitMQ event: chat.call.initiated
     │
Spring Boot:
  Create call record:
    status: RINGING
    started_at: now
  If Juma offline → FCM HIGH priority:
    { type: INCOMING_CALL, callId, callerName, callType: VOICE }
     │
[Juma's phone rings]
Juma taps Answer
     │
     ▼ Juma sends Jingle session-accept via Ejabberd WS
ICE negotiation begins between devices:
     │
     ├── P2P possible? (good network)
     │     Direct connection established □
     │     No Coturn bandwidth used
     │
     └── P2P blocked? (EA carrier NAT)
           Both connect to Coturn relay
           Audio flows: Kibuti → Coturn → Juma
     │
Call live □□
RTCP monitors quality every 200ms:
  Good network    → Opus 32-64kbps, clear voice
  3G              → Opus 16kbps, still good
  2G              → Opus 8kbps, slightly robotic but connected
  Very poor       → Opus 6kbps, minimum viable
     │
Kibuti taps End
     │
     ▼ Jingle session-terminate via Ejabberd WS
```

```
Ejabberd fires: chat.call.ended
Spring Boot:
  Update call record:
    status: COMPLETED
    ended_at: now
    duration_seconds: calculated
    relay_used: true/false
```

Call State Machine

```
IDLE
  | user taps Call
  ▼
INITIATING
  | getting TURN credentials
  | creating WebRTC offer
  ▼
RINGING ──────────────────────► MISSED (45s timeout)
  | Jume answers
  ▼
CONNECTING
  | ICE negotiation
  | finding best path
  ▼
CONNECTED ────────────────────► RECONNECTING (network drop)
  | call live                        | ICE restart
  |                                  | 10s timeout → FAILED
  | user ends
  ▼
ENDING
  | Jingle terminate sent
  ▼
COMPLETED / MISSED / DECLINED / FAILED
```

Codec Ladder — Opus Adaptive

```
Network             Bitrate    Quality
──────────────────────────────────────────────

WiFi / 4G strong    64 kbps    HD voice
```

```
4G standard          32 kbps    Clear
3G                   16 kbps    Good enough
2G / Edge             8 kbps    Robotic but connected
Barely alive          6 kbps    Minimum viable
──────────────────────────────────────────────────

Opus switches automatically based on RTCP feedback
No configuration needed — adaptive by design
```

---

10. Video Calls

Same Architecture as Voice + Camera

```
Everything from voice call applies
Additional components:

Video codec:    H.264 (primary)
                Hardware accelerated on Tecno, Infinix, Samsung
                Low battery drain — GPU handles encoding
                Fallback: VP8 (software, more CPU)

Camera:         Front camera default (switchable)
                Device detects capability at call start

Resolution ladder (adaptive):
──────────────────────────────────────────────────
WiFi              720p   30fps   1.5 Mbps
4G strong         480p   24fps   800 kbps
3G                360p   15fps   400 kbps
2G                240p   10fps   150 kbps
Very poor         VIDEO OFF — audio only (Opus)
──────────────────────────────────────────────────

Degradation order (never drops call):
  1. Reduce color depth
  2. Reduce resolution (720→480→360→240)
  3. Reduce frame rate (30→24→15→10fps)
  4. Reduce audio bitrate
```

```
  5. Disable video entirely → audio only
  6. Reduce audio to minimum (6kbps Opus)
```

Device Tier Detection

```
App detects device capability at call start:

High-end (Pixel, Samsung S series):
  H.264 hardware encoder (GPU)
  Start at 720p 30fps
  Low battery impact

Mid-range (Samsung A series):
  H.264 hardware encoder
  Start at 480p 24fps
  Medium battery impact

Low-end (Tecno Spark, Infinix Hot):
  H.264 software encoder (CPU)
  Start at 360p 15fps
  High battery impact
  Show warning: "Video call may drain battery faster"
  Auto-disable video after 10min if battery < 20%
```

Jingle for Video — Additional Content Block

```
<!-- Video call adds video content block -->
<jingle action="session-initiate" sid="session-xyz">

  <!-- Audio block (same as voice) -->
  <content name="audio">
    <description media="audio">
      <payload-type name="opus" clockrate="48000"/>
    </description>
    <transport .../>
  </content>

  <!-- Video block (added for video calls) -->
  <content name="video">
```

```
    <description media="video">
      <payload-type id="96" name="H264" clockrate="90000"/>
      <payload-type id="97" name="VP8"  clockrate="90000"/>
    </description>
    <transport .../>
  </content>

</jingle>
```

---

11. Coturn — TURN Relay

Why TURN is Mandatory for EA

```
Direct P2P (ideal):
  Both devices negotiate directly
  Audio/video flows device-to-device
  Ejabberd not involved in media
  No bandwidth cost on your servers

EA reality — P2P often blocked:
  Vodacom, Airtel, Tigo use CGNAT
  Multiple users share one public IP
  P2P connection cannot be established
  Without TURN → call fails

TURN relay (fallback):
  Both devices connect to Coturn
  Coturn relays audio/video between them
  Call works regardless of carrier NAT
  Bandwidth cost on your server (~50KB/min voice)
```

Coturn Config Highlights

```
listening-port=3478
tls-listening-port=5349
relay-ip=YOUR_COTURN_VPS_IP
```

```
realm=nexgate.com
lt-cred-mech               # time-limited credentials
use-auth-secret
static-auth-secret=${COTURN_SECRET}   # from Vault
min-port=49152
max-port=65535
```

TURN Credentials Generation

```
Credentials are time-limited HMAC tokens
Generated by Spring Boot per call session
Coturn validates them — prevents abuse

Format:
  username: {userId}:{expiry_timestamp}
  credential: HMAC-SHA1(secret, username)
  ttl: 3600 seconds (1 hour per call)

Only NexGate users can use your TURN server
No credential → Coturn rejects connection
```

Bandwidth Estimation

```
Voice call via TURN:
  Opus 16kbps × 2 directions = ~4KB/min
  1 hour call ≈ 240KB per participant

Video call via TURN:
  360p H.264 × 2 directions = ~6MB/min
  Force 360p max when on relay to control cost

Coturn VPS sizing:
  Hetzner CX11 (€4/month, 1vCPU/2GB)
  20TB bandwidth included
  Handles ~500 concurrent voice relay calls
  Upgrade to CX21 at scale
```

---

12. MessagePack Encoding

Why Switch from JSON

```
JSON message frame:
{"type":"MSG_SEND","conv_id":"conv-123456","sender_id":"usr-789012",
 "body":"Habari","timestamp":1719446400000,"temp_id":"abc-def-ghi"}

Size: ~140 bytes
Every key repeated as string on every message
Numbers encoded as ASCII characters
Parsing: character by character

MessagePack same message:
[binary representation]

Size: ~50 bytes
Keys encoded as integers (schema registered)
Numbers encoded as actual bytes (int32 = 4 bytes)
Parsing: read fixed byte positions

Result:
  60-65% smaller on wire
  3-5x faster to parse
  Critical for users on 2G/3G with limited data bundles
```

Migration Strategy (No Breaking Change)

```
Both formats supported simultaneously:

Client sends header:
  Content-Type: application/msgpack   → MessagePack
  Content-Type: application/json      → JSON (default)

Ejabberd detects Content-Type
Routes to appropriate deserializer

Migration flow:
```

```
  Old app version → sends JSON → works fine
  New app version → sends MessagePack → works fine
  No forced update required
  Gradual migration over 30-60 days
  Remove JSON support after 90%+ adoption
```

---

13. Broadcast Channels

What They Are

```
Creator → unlimited followers
One-directional: creator posts, followers receive
Like Telegram channels
No replies from followers (unless creator enables Q&A)

Use cases:
  Shop announcement channel ($techstore updates)
  Creator content channel (@kibuti posts)
  NexGate system channel (platform announcements)
```

Fan-out Strategy

```
Small channel (< 10,000 followers):
  Write-on-send — Chat Service pushes to each follower
  Same as group chat fan-out

Large channel (10,000+ followers):
  Lazy fan-out — store message once
  Followers fetch on open (read-time delivery)
  No per-follower push for casual followers
  FCM push only to followers with notifications enabled

Same celebrity bypass pattern as VP Feed:
  Hot channels → read-time merge
  Normal channels → write-time fan-out
```

Ejabberd MUC for Channels

```
Broadcast channel = MUC room with restrictions:
  Only owner/admins can send messages
  Members are read-only subscribers
  mod_muc handles this with role configuration:
    Role: moderator → can send
    Role: visitor   → read only

This means channels are built on the
same MUC infrastructure as group chats
No separate implementation needed
```

---

14. MQTT — Mini Apps Foundation

What MQTT Enables

```
Ejabberd runs MQTT broker on port 1883
No extra infrastructure — already in Ejabberd

Mini Apps subscribe to topics:
  orders/{orderId}         → real-time order updates
  delivery/{trackingId}    → GPS delivery tracking
  live/{streamId}/viewers  → viewer count updates
  jiko/{restaurantId}      → JikoXpress kitchen events

Spring Boot publishes events:
  Order shipped → publish to orders/{orderId}
  Mini App receives instantly
  No polling needed
```

MQTT vs XMPP for Mini Apps

```
XMPP (chat):
  Full protocol, complex stanzas
  Designed for human conversation
```

```
  Bidirectional, stateful sessions
  Right tool for chat

MQTT (events):
  Lightweight pub/sub protocol
  Designed for IoT and event streams
  Minimal overhead (2-byte header)
  Right tool for Mini App events
  Works on very limited connections

Both live inside Ejabberd:
  Same server, different protocols
  Mobile app uses XMPP for chat
  Mini Apps use MQTT for events
  Zero additional infrastructure
```

---

15. Message Interactions

All message interaction features are handled via standard XMPP XEPs. Ejabberd routes the stanzas automatically — Spring Boot handles persistence and business rules via RabbitMQ events.

Overview — All Four Features

```
Feature              XEP          Status      Ejabberd
──────────────────────────────────────────────────────
Edit message         XEP-0308     Stable □   auto routed
Delete for everyone  XEP-0424     Stable □   auto routed
Reactions            XEP-0444     Stable □   auto routed
Forwarding           XEP-0297     Stable □   auto routed
Reply to message     XEP-0461     Experimental auto routed
Stable stanza IDs    XEP-0359     Stable □   auto assigned
──────────────────────────────────────────────────────

All routed by Ejabberd
Spring Boot handles: validation, persistence, rules
```

XEP-0359 — Stable Stanza IDs (Foundation)

Before the features — this XEP is the foundation all others depend on. Every message gets a stable server-assigned ID used by reactions, edits, retractions, and replies to reference the correct message.

```
<!-- Ejabberd automatically adds stanza-id to every message -->
<message from="kibuti@nexgate.com"
         to="juma@nexgate.com"
         id="client-generated-id">
  <body>Habari</body>
  <stanza-id xmlns="urn:xmpp:sid:0"
             id="server-stable-id-abc123"
             by="nexgate.com"/>
  <!-- server-stable-id-abc123 is what reactions/edits reference -->
</message>
```

Message Editing — XEP-0308

```
Who can edit:    Original sender only
Time window:     15 minutes after send
What:            Text body only
Commerce cards:  □ BLOCKED — financial records are immutable
System messages: □ BLOCKED — never editable
```

```
<!-- Kibuti edits his message -->
<message from="kibuti@nexgate.com"
         to="juma@nexgate.com"
         type="chat"
         id="edit-002">

  <body>Habari yako Juma, vipi biashara?</body>

  <replace xmlns="urn:xmpp:message-correct:0"
           id="server-stable-id-abc123"/>
  <!-- references original message by stanza-id -->

</message>
```

```
Flow:
Kibuti edits → stanza sent via Ejabberd WS
```

```
Ejabberd routes to Juma (if online)
Ejabberd fires RabbitMQ: chat.message.edited
     |
Spring Boot:
  Is sender original author? □
  Within 15 minute window? □
  Not a commerce/system message? □
  Update messages.body = new text
  Update messages.edited_at = now
  Increment messages.edit_count
     |
Juma's app:
  Receives edit stanza
  Updates message in place (same position in thread)
  Shows "Edited" label under message

Group chats:
  Same stanza sent to MUC room JID
  Ejabberd MUC broadcasts to all members
  All see updated message simultaneously
```

Delete for Everyone — XEP-0424

```
Two delete modes:

Delete for me:
  Local filter only
  No Ejabberd stanza needed
  Spring Boot records: message_deletions (scope: SELF)
  Recipient unaffected

Delete for everyone:
  XEP-0424 retraction stanza
  Ejabberd routes to all recipients
  Time window: 15 minutes
  Commerce cards: □ BLOCKED
  System messages: □ BLOCKED
```

```
<!-- Delete for everyone — retraction stanza -->
<message from="kibuti@nexgate.com"
         to="juma@nexgate.com"
         type="chat"
         id="retract-003">

  <apply-to xmlns="urn:xmpp:fasten:0"
            id="server-stable-id-abc123">
    <retract xmlns="urn:xmpp:message-retract:1"/>
  </apply-to>

</message>
```

```
Flow:
Kibuti retracts → stanza via Ejabberd WS
Ejabberd routes to Juma
Ejabberd fires RabbitMQ: chat.message.retracted
     │
Spring Boot:
  Is sender original author? □
  Within 15 minute window? □
  Not blocked message type? □
  Soft delete:
    messages.deleted_at = now
    messages.deleted_by = usr-kibuti
    messages.delete_scope = EVERYONE
    body NOT removed (audit trail kept)
     │
Juma's app:
  Receives retraction stanza
  Replaces message with:
    "This message was deleted"
  Same position in thread

Nothing is ever hard deleted from PostgreSQL:
  Legal compliance (EA regulations)
  Dispute resolution (order/payment disputes)
  Admin investigation (fraud cases)
  Soft delete always — hard delete never
```

Reactions — XEP-0444

```
Model:          One reaction per user per message
Emoji set:      Limited set at launch
                ❤□  □□ □□ □□ □□ □□
Change:         Send new emoji → replaces old
Remove:         Send empty → removes reaction
Commerce cards: □ ALLOWED (reactions don't modify content)
System messages: □ BLOCKED
```

```
<!-- Kibuti reacts □□to message -->
<message from="kibuti@nexgate.com"
         to="juma@nexgate.com"
         type="chat"
         id="reaction-001">

  <reactions xmlns="urn:xmpp:reactions:0"
             id="server-stable-id-abc123">
    <reaction>□□/reaction>
  </reactions>

</message>

<!-- Kibuti changes to ❤□ -->
<message ...>
  <reactions xmlns="urn:xmpp:reactions:0"
             id="server-stable-id-abc123">
    <reaction>❤□</reaction>
  </reactions>
</message>

<!-- Kibuti removes reaction -->
<message ...>
  <reactions xmlns="urn:xmpp:reactions:0"
             id="server-stable-id-abc123">
    <!-- empty = removed -->
  </reactions>
</message>
```

```
Flow:
Kibuti taps □□→ reaction stanza via Ejabberd WS
Ejabberd routes to Juma
Ejabberd fires RabbitMQ: chat.message.reaction
     |
Spring Boot:
  Upsert in message_reactions:
    ON CONFLICT (message_id, user_id)
    → update emoji + timestamp
  Empty emoji received → delete reaction record
     |
Juma's app:
  Receives reaction stanza
  Updates reaction display below message:
    □□1
  Kibuti's own reaction: highlighted

Group chats:
  Stanza sent to MUC room
  Ejabberd MUC broadcasts to all members
  All screens update simultaneously:
    □□3  ❤□ 2  □□1

Notification:
  Reaction on your message → FCM push
  "Juma reacted □□to your message"
  Level: NORMAL (FCM only — no SMS)
  Muted conversations → no reaction notification
```

Message Forwarding — XEP-0297

```
What it is:
  Client creates NEW message in target conversation
  Original message wrapped inside as reference
  Server never "moves" anything
  Forwarded label shown with original sender name

Forward chain tracking:
```

```
  chain = 1:    "↪ Forwarded from Juma Mwangi"
  chain = 2-4:  "↪ Forwarded"
  chain = 5+:   "↪ Forwarded many times" (misinformation warning)

Multi-forward:  up to 5 conversations per action
Max chain:      no hard limit but UI degrades label

Commerce rules:
  Product card:        ✅ anyone can forward
  Custom price offer:  ❌ private deal — blocked
  Order confirmation:  ❌ private record — blocked
  Payment record:      ❌ private record — blocked
  System messages:     ❌ blocked
```

```
<!-- Kibuti forwards Juma's message to Amina -->
<message from="kibuti@nexgate.com"
         to="amina@nexgate.com"
         type="chat"
         id="fwd-001">

  <body>Angalia hii</body>

  <forwarded xmlns="urn:xmpp:forward:0">

    <delay xmlns="urn:xmpp:delay"
           stamp="2026-07-02T10:32:00Z"/>
    <!-- original send time preserved -->

    <message from="juma@nexgate.com"
             to="kibuti@nexgate.com"
             type="chat"
             id="msg-original-001">
      <body>Habari yako rafiki!</body>
    </message>

  </forwarded>

  <!-- NexGate forward metadata -->
  <nexgate-forward xmlns="urn:nexgate:forward">
    <original_sender_name>Juma Mwangi</original_sender_name>
```

```
    <forward_chain>1</forward_chain>
  </nexgate-forward>

</message>
```

```
Flow:
Kibuti taps Forward on Juma's message
Picks Amina's conversation
App creates new message stanza (not routing original)
Sends via Ejabberd WS to Amina
Ejabberd routes normally as new message
Fires RabbitMQ: chat.message.inbound (same as any message)
     |
Spring Boot:
  Validates forward is allowed (type check)
  Creates new messages record:
    is_forwarded: true
    original_sender_name: "Juma Mwangi"
    forward_chain: 1
    media_ref: original fileId (no re-upload)
     |
Amina's app:
  Receives as new message
  Renders with forwarded label:
  ┌──────────────────────────────────┐
  | ↪ Forwarded from Juma Mwangi  |
  |                                  |
  | Habari yako rafiki!              |
  |                          10:45  |
  └──────────────────────────────────┘

Media forwarding:
  References original fileId — no re-upload
  10 people forward same image
  → 1 file in MinIO, 10 message records
  File Thunder serves same file to all
```

Message Replies — XEP-0461

```
Reply to a specific message in thread
Like WhatsApp/Telegram quote-reply
Shows original message above reply

Status: Experimental ⚠
  Not yet stable standard
  But widely implemented
  (Gajim, Monal, many others use it)
  Safe to implement — unlikely to change drastically
```

```
<!-- Juma replies to Kibuti's specific message -->
<message from="juma@nexgate.com"
         to="kibuti@nexgate.com"
         type="chat"
         id="reply-001">

  <body>Nzuri sana, asante!</body>

  <reply xmlns="urn:xmpp:reply:0"
         to="kibuti@nexgate.com"
         id="server-stable-id-abc123"/>
  <!-- id references the message being replied to -->

</message>
```

```
UI renders:

┌──────────────────────────────────┐
│ ┌──────────────────────────┐     │
│ │ Kibuti                   │     │  ← quoted original
│ │ Habari yako Juma!        │     │
│ └──────────────────────────┘     │
│                                  │
│ Nzuri sana, asante!              │
│                          10:47   │
└──────────────────────────────────┘

Tap on quote → scroll to original message
```

Commerce Messages — Interaction Rules Summary

Message type	Edit	Delete(all)	React	Forward
Text message	✅ 15m	✅ 15m	✅	✅
Voice note	✅	✅ 15m	✅	✅
Image / Video	✅	✅ 15m	✅	✅
Product card	✅	✅	✅	✅
Custom price offer	✅	✅	✅	✅
Order confirmation	✅	✅	✅	✅
Payment confirmation	✅	✅	✅	✅
System message	✅	✅	✅	✅

Why commerce cards are protected:

- Immutable negotiation record
- Seller cannot change agreed price after the fact
- Buyer cannot claim different price was offered
- Full audit trail in thread — legally important

RabbitMQ Events — New in Phase 2 for Interactions

Exchange: nexgate.chat (topic) — additions:

Routing Key	Fired When
chat.message.edited	XEP-0308 received
chat.message.retracted	XEP-0424 received
chat.message.reaction	XEP-0444 received
chat.message.forwarded	XEP-0297 received
chat.message.delete_self	delete for me (REST call)

16. Docker Deployment

docker-compose additions for Phase 2

```
  ejabberd:
    image: ghcr.io/processone/ejabberd:latest
    container_name: ejabberd
    restart: unless-stopped
    ports:
      - "5222:5222"     # XMPP TCP
      - "5280:5280"     # WebSocket + HTTP
      - "1883:1883"     # MQTT
      - "3478:3478/udp" # STUN
    volumes:
      - ./ejabberd/ejabberd.yml:/home/ejabberd/conf/ejabberd.yml
      - ./ejabberd/data:/home/ejabberd/database
      - ./ejabberd/logs:/home/ejabberd/logs
    environment:
      - EJABBERD_BYPASS_WARNINGS=true
    depends_on:
      - postgres
      - rabbitmq
    networks:
      - nexgate-internal

  # Coturn on separate VPS — not in same compose
  # Deployed independently on Hetzner CX11
  # Connects back to NexGate via internal network
```

Traefik — WebSocket Routing

```
  # Ejabberd service labels for Traefik

  labels:
    - "traefik.enable=true"

    # App connects here for chat
    - "traefik.http.routers.chat.rule=Host(`chat.nexgate.com`)"
```

```
  - "traefik.http.routers.chat.tls=true"
  - "traefik.http.routers.chat.tls.certresolver=letsencrypt"
  - "traefik.http.services.chat.loadbalancer.server.port=5280"

  # Sticky sessions — CRITICAL for WebSocket
  # Same user must always hit same Ejabberd node
  - "traefik.http.services.chat.loadbalancer.sticky.cookie=true"
  - "traefik.http.services.chat.loadbalancer.sticky.cookie.name=ejabberd_node"
```

```
Why sticky sessions:
  User connected to Ejabberd Node 1
  Next request hits Node 2
  → connection context lost → disconnected

  Sticky cookie ensures:
    usr-123 always → Node 1
    usr-456 always → Node 2
    WS sessions stable across load balancer
```

Ejabberd Cluster Config

```
# Second node joins cluster
# On node 2's ejabberd.yml:

hosts:
  - "nexgate.com"

# Erlang cookie must match on all nodes
# Set via environment variable
# Both nodes discover each other automatically
# Erlang distributed handles the rest

# Result:
#   Message to usr-456 arrives on Node 1
#   usr-456 connected to Node 2
#   Erlang routes internally — transparent
```

17. Database Schema

calls (new in Phase 2)

```
calls
──────────────────────────────────────────────────

call_id           UUID          PK
caller_id         UUID
receiver_id       UUID
conversation_id   UUID          FK → conversations
type              ENUM          VOICE / VIDEO
status            ENUM          RINGING / CONNECTED / COMPLETED /
                                MISSED / DECLINED / FAILED
started_at        TIMESTAMPTZ
answered_at       TIMESTAMPTZ
ended_at          TIMESTAMPTZ
duration_seconds  INT
relay_used        BOOLEAN
end_reason        ENUM          NORMAL / NETWORK / TIMEOUT / DECLINED
```

call_quality_logs (new in Phase 2)

```
call_quality_logs
──────────────────────────────────────────────────

log_id            UUID          PK
call_id           UUID          FK → calls
timestamp         TIMESTAMPTZ
direction         ENUM          OUTBOUND / INBOUND
bitrate_kbps      INT
packet_loss_pct   DECIMAL
jitter_ms         INT
rtt_ms            INT
resolution        TEXT          "360p" "480p" "720p" or null
codec_audio       TEXT          "opus"
codec_video       TEXT          "h264" "vp8" or null
```

broadcast_channels (new in Phase 2)

```
broadcast_channels
──────────────────────────────────────────────
channel_id        UUID          PK
owner_id          UUID          userId or shopId
owner_type        ENUM          USER / SHOP
name              TEXT
description       TEXT
avatar_file_id    UUID
subscriber_count  INT
type              ENUM          PERSONAL / SHOP / SYSTEM
created_at        TIMESTAMPTZ
```

message_reactions (new in Phase 2)

```
message_reactions
──────────────────────────────────────────────
id                UUID          PK
message_id        UUID          FK → messages
conversation_id   UUID          FK → conversations
user_id           UUID
emoji             TEXT          "□□ "❤□" "□□ etc
reacted_at        TIMESTAMPTZ

Unique constraint: (message_id, user_id)
  → one reaction per user per message
  → upsert on conflict replaces emoji
```

message_deletions (new in Phase 2)

```
message_deletions
──────────────────────────────────────────────
id                UUID          PK
message_id        UUID          FK → messages
deleted_by        UUID          userId
scope             ENUM          SELF / EVERYONE
deleted_at        TIMESTAMPTZ
```

messages table additions (Phase 2)

```
New columns added to existing messages table:

edited_at             TIMESTAMPTZ    when last edited
edit_count            INT            how many times edited
original_body         TEXT           body before first edit (audit)
deleted_at            TIMESTAMPTZ    soft delete timestamp
deleted_by            UUID           who deleted
delete_scope          ENUM           SELF / EVERYONE
is_forwarded          BOOLEAN        was this forwarded
forward_chain         INT            forwarding depth (1,2,3...)
original_sender_name  TEXT           display name at forward time
original_message_id   UUID           source message if forwarded
reply_to_id           UUID           FK → messages (for replies)
stanza_id             TEXT           Ejabberd XEP-0359 stable ID
```

---

18. Commerce Stanzas & Custom Namespaces

The Extensible Part of XMPP

XMPP was designed to be extended by anyone for anything. The "X" in XMPP = Extensible.

Any application can add custom XML elements inside standard XMPP stanzas using their own namespace. Ejabberd routes the entire stanza as-is — it never parses, validates, or modifies custom elements. Spring Boot reads them on the other side.

```
Standard stanza:
  <message from="a@nexgate.com" to="b@nexgate.com">
    <body>Habari</body>
  </message>

With NexGate custom element:
  <message from="a@nexgate.com" to="b@nexgate.com">
    <body>Habari</body>
    <nexgate-offer xmlns="urn:nexgate:offer:1">
      ... your custom data here ...
```

```
    </nexgate-offer>
  </message>

Ejabberd:
  Routes whole stanza as-is □
  Never touches nexgate-offer element □
  Never validates it □
  Just delivers it □
```

NexGate Namespace Registry

```
All custom namespaces NexGate defines:

urn:nexgate:commerce:1     product cards
urn:nexgate:offer:1        price offer sessions
urn:nexgate:groupbuy:1     Bei ya pamoja cards
urn:nexgate:event:1        event cards
urn:nexgate:feed:1         VP Feed post cards
urn:nexgate:live:1         live stream cards
urn:nexgate:audio:1        audio space cards
urn:nexgate:system:1       system messages
urn:nexgate:forward        forwarding metadata
urn:nexgate:states         recording voice note state
urn:nexgate:meta           message metadata

Versioning (:1, :2):
  Allows schema evolution
  Old app sees :1 → renders fine
  New app sees :2 → renders richer UI
  Old clients fall back to <body> text
  No breaking changes
```

Product Card Stanza

```
Sent by: Spring Boot via Ejabberd REST API
When:    Buyer taps "Chat with Seller" on product page
```

```
<message from="system@nexgate.com"
         to="techstore@shops.nexgate.com"
         type="chat"
         id="card-001">

  <!-- Fallback for basic clients -->
  <body>Mteja anaomba habari: Samsung A15</body>

  <nexgate-commerce xmlns="urn:nexgate:commerce:1">
    <type>PRODUCT_CARD</type>
    <initiated_by>usr-kibuti</initiated_by>
    <conv_id>conv-789</conv_id>

    <product>
      <id>prod-123</id>
      <name>Samsung A15</name>
      <public_price>450000</public_price>
      <currency>TZS</currency>
      <image_url>https://cdn.nexgate.com/img.jpg</image_url>
      <stock>12</stock>
      <shop_name>TechStore</shop_name>
      <shop_id>shop-456</shop_id>
      <snapshot_at>2026-07-13T08:30:00Z</snapshot_at>
      <!-- price frozen at this moment — never changes -->
    </product>
  </nexgate-commerce>

</message>
```

```
Seller's app renders:

  ┌──────────────────────────────────────┐
  │ □□Samsung A15                        │
  │ TZS 450,000                          │
  │ Inapatikana: Vipande 12              │
  │ TechStore                            │
  │ [Jibu]  [Angalia Bidhaa]             │
  └──────────────────────────────────────┘
```

Custom Price Offer Stanza

```
Sent by: Seller's app via Ejabberd WebSocket
When:    Seller attaches price offer from shop
         (both Flow 1 post-negotiation and Flow 2 direct attach)
```

```
<message from="techstore@shops.nexgate.com/amina"
         to="kibuti@nexgate.com"
         type="chat"
         id="offer-002">

  <body>Bei yako maalum: TZS 400,000</body>

  <nexgate-offer xmlns="urn:nexgate:offer:1">
    <offer_id>offer-uuid-abc</offer_id>
    <conv_id>conv-789</conv_id>
    <valid_minutes>30</valid_minutes>
    <initiated_by>SELLER</initiated_by>

    <product>
      <id>prod-123</id>
      <name>Samsung A15</name>
      <image_url>https://cdn.nexgate.com/img.jpg</image_url>
      <shop_name>TechStore</shop_name>
      <shop_id>shop-456</shop_id>
    </product>

    <pricing>
      <public_price>450000</public_price>
      <offer_price>400000</offer_price>
      <currency>TZS</currency>
      <discount_amount>50000</discount_amount>
      <discount_pct>11</discount_pct>
    </pricing>

    <!-- Staff who sent offer — not visible to buyer -->
    <!-- Buyer always sees "TechStore" not "Amina" -->
    <sent_by_staff>usr-amina</sent_by_staff>
```

```
  </nexgate-offer>

</message>
```

```
Buyer's app renders:

  ┌──────────────────────────────────────┐
  │ □□Bei Maalum Kwako                   │
  │ Samsung A15                          │
  │ ~~TZS 450,000~~                      │
  │ TZS 400,000  (umepunguziwa 50,000)   │
  │ Inaisha: dakika 30                   │
  │ Idadi: [−  1  +]                     │
  │ [Kataa]    [Endelea Kulipa →]        │
  └──────────────────────────────────────┘
```

Offer Response Stanzas

```
<!-- Buyer declines offer -->
<message from="kibuti@nexgate.com"
         to="techstore@shops.nexgate.com"
         type="chat"
         id="resp-003">

  <body>Nimekataa bei hii</body>

  <nexgate-offer xmlns="urn:nexgate:offer:1">
    <offer_id>offer-uuid-abc</offer_id>
    <response>DECLINED</response>
  </nexgate-offer>

</message>

<!-- System sends expiry notification -->
<message from="system@nexgate.com"
         to="conv-789-participants"
         type="chat"
         id="expire-004">
```

```
  <nexgate-offer xmlns="urn:nexgate:offer:1">
    <offer_id>offer-uuid-abc</offer_id>
    <response>EXPIRED</response>
    <message_id>offer-002</message_id>
    <!-- references offer card message to update its UI -->
  </nexgate-offer>

</message>
```

Order Confirmation Stanza

```
Sent by: Spring Boot via Ejabberd REST API
When:    Buyer completes checkout successfully
```

```
<message from="system@nexgate.com"
         to="conv-789-participants"
         type="chat"
         id="confirm-005">

  <body>Agizo limefanikiwa!</body>

  <nexgate-system xmlns="urn:nexgate:system:1">
    <type>ORDER_CONFIRMATION</type>
    <order_id>ord-xyz-789</order_id>
    <conv_id>conv-789</conv_id>
    <offer_id>offer-uuid-abc</offer_id>

    <summary>
      <product_name>Samsung A15</product_name>
      <quantity>1</quantity>
      <amount_paid>400000</amount_paid>
      <currency>TZS</currency>
      <status>CONFIRMED</status>
    </summary>

  </nexgate-system>

</message>
```

```
Both buyer and seller see:
  ┌──────────────────────────────────────┐
  │  Agizo Limethibitishwa            │
  │ Ord #ORD-XYZ-789                     │
  │ Samsung A15 × 1                      │
  │ TZS 400,000 imelipwa                 │
  │ [Fuatilia Agizo]                     │
  └──────────────────────────────────────┘
```

Bei ya Pamoja Card Stanza

```
<message from="kibuti@nexgate.com"
         to="juma@nexgate.com"
         type="chat"
         id="gb-006">

  <body>Jiunge na group buy hii!</body>

  <nexgate-groupbuy xmlns="urn:nexgate:groupbuy:1">
    <group_buy_id>gb-xyz</group_buy_id>
    <product_id>prod-123</product_id>
    <product_name>Samsung A15</product_name>
    <product_image>https://cdn.nexgate.com/img.jpg</product_image>
    <group_price>350000</group_price>
    <public_price>450000</public_price>
    <currency>TZS</currency>
    <current_participants>7</current_participants>
    <target_participants>10</target_participants>
    <expires_at>2026-07-13T18:00:00Z</expires_at>
  </nexgate-groupbuy>

</message>
```

Event Card Stanza

```
<message from="kibuti@nexgate.com"
         to="juma@nexgate.com"
```

```
          type="chat"
          id="evt-007">

  <body>Jiunge na event hii!</body>

  <nexgate-event xmlns="urn:nexgate:event:1">
    <event_id>evt-456</event_id>
    <title>Dar Tech Summit 2026</title>
    <date>2026-08-15T09:00:00Z</date>
    <venue>Julius Nyerere ICC, Dar es Salaam</venue>
    <ticket_price>25000</ticket_price>
    <currency>TZS</currency>
    <cover_image>https://cdn.nexgate.com/evt.jpg</cover_image>
    <available_tickets>150</available_tickets>
  </nexgate-event>

</message>
```

VP Feed Post Card Stanza

```
<message from="kibuti@nexgate.com"
          to="juma@nexgate.com"
          type="chat"
          id="post-008">

  <body>Angalia post hii</body>

  <nexgate-feed xmlns="urn:nexgate:feed:1">
    <post_id>post-789</post_id>
    <author_name>Kibuti Mwangi</author_name>
    <author_avatar>https://cdn.nexgate.com/av.jpg</author_avatar>
    <caption>Bidhaa mpya zimefika! □□/caption>
    <media_url>https://cdn.nexgate.com/post.jpg</media_url>
    <media_type>IMAGE</media_type>
    <like_count>245</like_count>
  </nexgate-feed>

</message>
```

Spring Boot — How It Handles Custom Stanzas

```
All stanzas arrive via RabbitMQ: chat.message.inbound
Spring Boot parses XML and routes by namespace:

  Namespace detected           Handler
  ──────────────────────────────────────────────────
  urn:nexgate:commerce:1       handleProductCard()
  urn:nexgate:offer:1          handleOfferSession()
  urn:nexgate:groupbuy:1       handleGroupBuy()
  urn:nexgate:event:1          handleEventCard()
  urn:nexgate:feed:1           handlePostCard()
  urn:nexgate:system:1         handleSystemMessage()
  none of the above            handleTextMessage()
```

Offer Session — Spring Boot Processing

```
CUSTOM_PRICE_OFFER received:

  Spring Boot:
    Create message record (type: CUSTOM_PRICE_OFFER)
    Create commerce_offer_sessions record:
      offer_id:       from stanza
      buyer_id:       conversation partner
      shop_id:        sender shop JID
      product snapshot: from stanza
      offer_price:    from stanza (server authoritative)
      expires_at:     now + valid_minutes
      status:         PENDING
    Schedule RabbitMQ delayed job:
      delay: valid_minutes
      payload: { offerId, action: EXPIRE }
    Send FCM to buyer:
      "TechStore amekutumia bei maalum"
      Level: IMPORTANT

  Buyer taps "Endelea Kulipa":
    POST /checkout/initiate { offerId, quantity }
```

```
  Spring Boot:
    Validate: status=PENDING, not expired, buyer matches
    Update status: CHECKOUT
    Price from DB — never from client □
    Return: { checkoutUrl, checkoutToken }

Order completes:
  Update status: COMPLETED
  order_id: linked
  Send ORDER_CONFIRMATION stanza to conversation

Expiry fires (RabbitMQ delayed job):
  Status still PENDING? → mark EXPIRED
  Status already changed? → do nothing
  Send OFFER_EXPIRED stanza to conversation
```

commerce_offer_sessions Table

```
commerce_offer_sessions
──────────────────────────────────────────────────────

offer_id              UUID        PK
conv_id               UUID        FK → conversations
message_id            UUID        FK → messages
shop_id               UUID
buyer_id              UUID
sent_by_staff         UUID        staff who sent (audit only)
product_id            UUID
product_name          TEXT
product_image_url     TEXT
snapshot_json         JSONB       full product at offer time
public_price          BIGINT      TZS
offer_price           BIGINT      TZS (custom — server auth)
currency              TEXT        TZS
quantity_min          INT
quantity_max          INT
discount_amount       BIGINT
discount_pct          DECIMAL
status                ENUM        PENDING / ACCEPTED /
```

```
                                DECLINED / EXPIRED /
                                CHECKOUT / COMPLETED /
                                CANCELLED / ABANDONED
valid_minutes         INT
expires_at            TIMESTAMPTZ
initiated_by          ENUM        BUYER / SELLER
notes                 TEXT
created_at            TIMESTAMPTZ
responded_at          TIMESTAMPTZ
checkout_at           TIMESTAMPTZ
completed_at          TIMESTAMPTZ
order_id              UUID        FK → orders (after completion)
```

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19. Build Order

NexGate chat is built from scratch — no migration, no Phase 1 to carry forward. This is the recommended sequence:

```
Week 1-2 — Local Experiments
  Ejabberd running in Docker locally
  Two containers (node1 + node2) clustered
  Auth bridge: Spring Boot validates XMPP tokens
  Send first message between two test JIDs
  Confirm Erlang dist working between nodes
  Confirm RabbitMQ events firing to Spring Boot

Week 3-4 — PostgreSQL Schema + Chat Service
  All tables created (messages, conversations,
  receipts, calls, offer sessions, reactions etc)
  Spring Boot Chat Service:
    RabbitMQ consumers for all Ejabberd events
    Message persistence
    Receipt tracking
    Notification routing (FCM + Textfy)

Week 5 — Ejabberd Staging Deployment
  Deploy to Hetzner staging VPS
  Two node cluster live
```

```
  Traefik sticky sessions configured
  Auth bridge connected to Chat Service
  Send first real message through staging Ejabberd

Week 6-7 — Mobile SDK + Basic Chat
  NexGate Chat SDK (Android + iOS)
    Smack / XMPPFramework wrapper
    Clean send/receive API
    Auto-reconnect + Stream Management
  Text messages working end-to-end
  Typing indicators
  Delivery + read ticks
  Presence (online/offline)

Week 8 — Message Interactions
  Reactions (XEP-0444)
  Edit messages (XEP-0308)
  Delete for everyone (XEP-0424)
  Forwarding (XEP-0297)
  Replies (XEP-0461)

Week 9 — Voice Calls
  TURN credentials endpoint in Spring Boot
  Coturn deployed (Hetzner CX11)
  Jingle signaling through Ejabberd
  WebRTC on Android/iOS
  Opus audio confirmed on 2G test
  Coturn relay confirmed on EA network

Week 10 — Video Calls
  H.264 video track added
  Adaptive resolution ladder
  Resolution ladder tested on 3G

Week 11 — Commerce DMs
  Custom namespace stanzas:
    PRODUCT_CARD
    CUSTOM_PRICE_OFFER
    OFFER_DECLINED / OFFER_EXPIRED
    ORDER_CONFIRMATION
```

```
  Offer session lifecycle
  Both commerce flows (buyer initiates + seller attaches)
  Checkout redirect flow
  Shop inbox isolation + access control

Week 12 — Group Chats + Broadcast
  MUC rooms (Ejabberd XEP-0045)
  Group message reactions
  Group typing indicators
  Broadcast channels (read-only MUC)

Week 13 — Offline + Notifications
  RabbitMQ offline queue
  FCM HIGH priority integration
  Textfy SMS escalation
  Notification levels (NORMAL/IMPORTANT/CRITICAL)
  Catch-up banner on reconnect

Week 14 — MessagePack
  MessagePack encoding in SDK
  Content-Type header detection in Ejabberd
  Both JSON + MessagePack supported simultaneously
  EA bandwidth savings confirmed

Week 15 — Testing + EA Network Testing
  Test on actual Vodacom/Airtel SIM cards
  Test on Tecno/Infinix devices
  Test on 2G/3G networks
  Call quality on Coturn relay confirmed
  Commerce flow end-to-end confirmed

Week 16 — Ship □□
  Production deployment
  Two Ejabberd nodes live
  All features confirmed
  NexGate chat is live
```

Summary

NexGate chat is built directly on Phase 2 architecture from scratch. No migration. No legacy code. Greenfield build on carrier-grade infrastructure from day one.

Ejabberd Cluster (two Docker containers, same Hetzner VPS at launch) handles all WebSocket connections, XMPP stanza routing, presence, MUC group chats, Jingle voice/video signaling, and 25+ chat features via standard XEPs — all at zero custom code cost. Erlang Distribution connects the two nodes directly, routing messages between them in microseconds without Redis pub/sub.

Spring Boot Chat Service owns all business logic — message persistence, commerce context, offer session lifecycle, shop inbox access control, notification routing, and call records. It communicates with Ejabberd asynchronously via RabbitMQ for all events except auth, which is synchronous HTTP because Ejabberd needs an immediate allow/deny decision.

Custom XMPP Namespaces extend the protocol for NexGate's commerce features. Product cards, custom price offers, offer session responses, Bei ya pamoja cards, event cards, and post cards all travel as custom XML elements inside standard XMPP stanzas. Ejabberd routes them as-is — Spring Boot parses and handles them. Commerce messages are server-authoritative and immutable: offer prices come from the database, not the client. Public product prices are never touched.

WebRTC + Coturn handles voice and video calls. Jingle stanzas through Ejabberd coordinate setup. Opus adapts audio from 64kbps on WiFi to 6kbps on 2G. H.264 hardware acceleration keeps video calls battery-friendly on EA phones. Coturn relay ensures calls work behind EA carrier NAT on Vodacom, Airtel, and Tigo.

MessagePack reduces message frame size 60-65% — real saving for EA users on limited data bundles. Both JSON and MessagePack supported simultaneously during SDK rollout.

The build is 16 weeks from local experiments to production. WhatsApp-class infrastructure. Commerce-aware from day one. EA network optimized throughout.

NexGate Chat Platform — Phase 2: Production Architecture v1.0 QBIT SPARK | Ejabberd · Coturn · WebRTC · Commerce Stanzas · Edit · Delete · React · Forward

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