

LifeBond Data Contract Specification v1.2.0

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A Complete Data Architecture for Multi-Season Life Simulation Gaming

Generated on October 14, 2025

Executive Summary

This specification defines the complete data contract for LifeBond, a multi-season life simulation game that tracks player progress, character development, NPC relationships, and narrative continuity across 8-10 seasons. The architecture supports Master Truths v1.2 requirements including emotional authenticity (0-10 capacity scale), numerical grounding (anchor-calculate-validate), memory resonance systems, and novel-quality narrative generation.

Core Data Principles

1. Emotional Authenticity

All data structures support authentic emotional experiences through:

- **Emotional Capacity Tracking:** 0-10 scale with stressor management
- **NPC Capacity Constraints:** Characters cannot provide unlimited support
- **Capacity Recovery:** Phase transitions provide partial capacity restoration
- **Support Rule:** NPCs can provide support up to their capacity + 2

2. Numerical Grounding (Master Truths v1.2 Requirement)

Every numerical assignment must include:

- **Anchor:** Qualitative tier (e.g., "MAJOR_HARM -1.5 to -2.0 range")
- **Calculate:** Explicit formula with factors
- **Validate:** Narrative confirmation that story matches number

Example:

```
trust_impact: -1.9
anchor: "MAJOR_HARM (-1.5 to -2.0 range)"
formula: "base(-0.5) × personality(0.7) × urgency(5.0) × trust(1.2) × capacity(0.9) = -1.8"
validation: "Dialogue shows hurt without melodrama, matches MAJOR_HARM expectations"
```

3. Multi-Season Continuity

Characters persist across seasons with:

- **Four-Tier Memory System:** Active → Recent → Compressed → Canonical
- **Memory Resonance:** 5 weighted types (0.7-0.95) determine recall priority
- **Tension Hook Persistence:** Cross-season narrative tracking
- **Life Bookshelf:** Generated novels from each completed season

4. Novel-Quality Narratives

All interactions aim for literary quality:

- **150-200 word responses** minimum for primary interactions
- **Behavioral grounding:** Show emotions through actions, not exposition
- **OCEAN personality visibility:** Traits influence every response
- **Dramatic irony scoring:** 0.6+ threshold for knowledge gap utilization

Player Character Schema

Core Structure

```
{
  "characterId": "uuid",
  "name": "string",
  "age": "integer (28-65)",
  "currentSeason": "integer (1-10)",
  "totalWeeksLived": "integer",
  "personality": "OCEANPersonality",
  "emotionalCapacity": "EmotionalCapacity",
  "lifeDirection": "enum[9_life_directions]",
  "currentAspiration": "Aspiration",
  "meters": "PlayerMeters",
  "skills": "SkillSet",
  "relationships": "array[Relationship]",
  "lifebookshelf": "LifeBookshelf",
  "memoryDatabase": "MultiTierMemorySystem"
}
```

OCEAN Personality Model

Big Five personality traits (1.0-5.0 scale) with evolution tracking:

- **Openness:** Curiosity, creativity, willingness to experience new things
- **Conscientiousness:** Organization, discipline, reliability
- **Extraversion:** Social energy, assertiveness, comfort in groups
- **Agreeableness:** Cooperation, empathy, concern for others
- **Neuroticism:** Emotional volatility, tendency toward negative emotions

Each trait includes evolution history tracking personality changes over seasons.

Emotional Capacity System (Master Truths v1.2)

```
{
  "currentCapacity": "number (0-10)",
  "baselineCapacity": "number (0-10)",
  "activeStressors": "array[Stressor]",
  "capacityTier": "enum[CRISIS|VERY_LOW|LOW|MODERATE|HIGH]",
  "capacityHistory": "array[CapacitySnapshot]",
  "supportAvailability": {
    "maxSupportLevel": "number (capacity + 2 rule)",
    "canProvideEmotionalSupport": "boolean",
    "canHandleCrisis": "boolean",
    "needsSupport": "boolean"
  }
}
```

Player Meters

Four core meters affecting capacity calculation:

- **Physical** (0-10): Health and energy
- **Mental** (0-10): Clarity and focus
- **Social** (0-10): Connections and support
- **Emotional** (0-10): Well-being and resilience

Skill System (30 Total Skills)

Categories

- **Creative:** Photography, Writing, Painting, Music Performance, Music Composition, Design, Video Production, Acting
- **Professional:** Business Management, Marketing, Sales, Project Management, Leadership, Public Speaking, Programming, Data Analysis, Accounting, Teaching
- **Physical:** Running, Strength, Yoga, Martial Arts, Swimming, Team Sports
- **Practical:** Cooking, Home Repair, Gardening, Advanced Driving, Financial Planning
- **Languages:** Spanish (expandable)

Learning Modifiers (Master Truths v1.2)

Skill learning affected by:

- **Capacity Multiplier:** 0.1x-1.2x based on current emotional capacity
- **OCEAN Modifiers:**
 - Openness: Bonus for creative/intellectual skills
 - Conscientiousness: Bonus for structured learning
 - Extraversion: Bonus for social/performance skills
- **Combined Multiplier:** Capacity × Personality = Final learning rate

Relationship System (Levels 0-5)

Relationship Levels

- **Level 0:** Not Met (internal tracking only)
- **Level 1:** Stranger (1-5 interactions)
- **Level 2:** Acquaintance (6-15 interactions)
- **Level 3:** Friend (16-30 interactions)
- **Level 4:** Close Friend (31-75 interactions)
- **Level 5:** Soulmate/Best Friend (76+ interactions)

Level-Up Requirements

Both interaction count AND minimum trust threshold required:

- **Level 1 → 2:** 6 interactions + 15% trust
- **Level 2 → 3:** 16 interactions + 30% trust + special moment
- **Level 3 → 4:** 31 interactions + 50% trust + 2 special requirements + 12 weeks minimum
- **Level 4 → 5:** 76 interactions + 75% trust + ALL special requirements + 24 weeks minimum

NPC Capacity Tracking (Master Truths v1.2)

NPCs have their own emotional capacity (0-10 scale):

- **Life events change NPC capacity:** Job loss (-3), breakup (-4), promotion (+1)
- **Support availability:** NPCs at capacity 3 cannot provide crisis support (level 8+ need)
- **Role reversal:** Sometimes player supports struggling NPCs
- **Narrative signals:** Capacity reflected in dialogue and behavior

Memory System Architecture

Four-Tier Memory System

Supporting multi-season continuity with intelligent compression:

Tier 1: Active Context (Last 12 weeks)

- **Detail Level:** Complete - every card play, conversation
- **Size:** ~2MB
- **Query Speed:** Instant
- **Used For:** Immediate continuity, recent references

Tier 2: Recent History (Previous 2-3 seasons)

- **Detail Level:** High - major events, relationship milestones, decisions
- **Size:** ~5MB
- **Query Speed:** Very fast
- **Used For:** Recent history references, relationship context

Tier 3: Compressed History (All earlier seasons)

- **Detail Level:** Heavily compressed (50:1 ratio)
- **Strategy:** Keep defining moments, discard routine
- **Size:** 5-10MB
- **Used For:** Long-term character arc, major life events

Tier 4: Canonical State (Current snapshot)

- **Detail Level:** Complete current character sheet
- **Size:** ~1MB
- **Used For:** What is true NOW

Memory Resonance System (Master Truths v1.2)

Five weighted resonance types determine recall priority:

1. **Past Trauma Trigger** (0.95 weight): Current situation mirrors traumatic experience
2. **Emotional Growth Callback** (0.85 weight): Opportunity to show character development
3. **Relationship Milestone Echo** (0.80 weight): Recalls relationship origin moments
4. **Success Origin Recall** (0.75 weight): Remember who believed when you didn't
5. **Parallel Situation Pattern** (0.70 weight): Similar situation, different context

Recall Formula: $\text{baseWeight} \times \text{situationMatch} \times \text{resonanceFactor}$

Threshold: Score ≥ 3.0 for memory to surface automatically

AI Context System

Seven-Layer Context Model

For AI prompt generation with token budget management:

1. **Character State** (CRITICAL, 300-500 tokens): Personality, capacity, recent memories
2. **Relationship History** (CRITICAL, 200-400 tokens): Trust levels, interaction history
3. **Current Interaction** (CRITICAL, 150-300 tokens): Activity, player choice, urgency assessment
4. **Player State** (IMPORTANT, 100-200 tokens): Emotional state, life context

5. **World Context** (OPTIONAL, 50-100 tokens): Time, season, ambience
6. **Dramatic Irony** (IMPORTANT, 150-250 tokens): Knowledge gaps for tension
7. **Meta Context** (IMPORTANT, 100-200 tokens): Evolution guidance, quality requirements

Urgency Assessment (Master Truths v1.2)

NPC Response Framework includes urgency multipliers:

- **Routine** (1x): No amplification
- **Important** (2x): Moderate amplification
- **Urgent** (3x): Strong amplification
- **Crisis** (5x): Maximum amplification

Crisis overrides personality - even agreeable NPCs become harsh under extreme urgency.

Dramatic Irony System

Knowledge Gap Scoring

Five components determine dramatic irony effectiveness (0.6+ threshold):

1. **Knowledge Clarity** (25% weight): How clear is the knowledge gap?
2. **Tension Created** (25% weight): How much anticipation/dread?
3. **Emotional Weight** (25% weight): How emotionally impactful?
4. **Player Investment** (15% weight): How much does player care?
5. **Timing Quality** (10% weight): Right moment for this irony?

Three Response Types

Character responses to dramatic irony situations:

- **Tone-Deaf**: Completely inappropriate response (player cringes)
- **Misguided**: Good intentions, wrong approach (player sympathizes)
- **Growth**: Gets it right (player relieved/proud)

Distribution based on emotional intelligence, capacity, and relationship level.

Capacity-Limited Perception

Low emotional capacity reduces ability to perceive others' needs:

- **Capacity 8+**: Character perceptive, caring, present
- **Capacity 5-7**: Character trying but not fully attentive
- **Capacity ≤3**: Character misses all signals, self-focused only

Tension Hook System

Cross-Season Persistence

Narrative tensions planted in one season can pay off seasons later:

```
{
  "hookId": "sarahDavidMystery",
  "seasonPlanted": 2,
  "weekPlanted": 14,
  "hookType": "mysteryHook",
  "tensionScore": 0.85,
  "status": "resolved",
  "payoffSeason": 2,
  "payoffWeek": 18,
  "qualityScoring": {
    "tensionBuilding": 0.87,
    "payoffQuality": 0.92,
    "narrativeCoherence": 0.95
  }
}
```

Hook Lifecycle Management

- **Planting:** Information gap created, player curiosity generated
- **Building:** Additional clues, tension escalation
- **Payoff:** Resolution with emotional impact
- **Validation:** All hooks must resolve or be explicitly abandoned

Firebase Data Architecture

Collection Structure

```
/players/{playerId}
- Player account, subscription, settings

/players/{playerId}/characters/{characterId}
- Character data, personality, current state

/players/{playerId}/characters/{characterId}/relationships/{npcId}
- Individual NPC relationships

/players/{playerId}/characters/{characterId}/memories/{memoryTier}
- Memory storage by tier

/players/{playerId}/characters/{characterId}/seasons/{seasonNumber}
- Season-specific data, generated novels

/players/{playerId}/characters/{characterId}/aiGenerations/{generationId}
- AI generation history and context
```

Data Optimization Strategy

- **Indexing:** Optimized for player queries and character access
- **Caching:** Tier-based memory caching (Tier 1 always cached)
- **Compression:** 50:1 ratio for historical data
- **Security:** User can only access their own data

Performance Targets

- **Total Memory Footprint:** 15-20MB for complete 8-10 season character
- **Query Performance:**
 - Tier 1: 10ms (in-memory hash)
 - Tier 2: 50ms (indexed search)
 - Tier 3: 100ms (compressed search)
 - Canonical Facts: 5ms (hash lookup)

Novel Generation & Life Bookshelf

Season-to-Novel Pipeline

Each completed season generates a novel for the character's Life Bookshelf:

1. **Quality Validation:** Season must meet Master Truths v1.2 thresholds
2. **Memory Consolidation:** High-emotional-weight moments preserved
3. **Novel Generation:** 8,000-60,000 words based on season length
4. **Archive Integration:** Added to character's permanent bookshelf

Quality Thresholds

- **Emotional Authenticity:** ≥ 0.70
- **Tension Building:** ≥ 0.65
- **Dramatic Irony:** ≥ 0.55 (when applicable)
- **Hook Effectiveness:** ≥ 0.70
- **Overall Quality:** ≥ 0.70

Life Bookshelf Limits

- **Base Limit:** 8 seasons (120,000+ words)
- **Premium Extension:** +2 seasons with Essence purchase
- **Character Lifecycle:** Active → Retired → Completed

Success Metrics & Validation

Emotional Authenticity Targets

- **Player satisfaction:** 4.2+/5.0 ("NPCs feel real")
- **Personality accuracy:** 87%+ OCEAN trait prediction
- **Sentiment accuracy:** 92%+ emotion classification
- **Coherence score:** 0.85+ internal consistency
- **Contradiction rate:** <2% canonical fact violations

Performance Benchmarks

- **Response time:** 90% feel instant (<100ms perceived)
- **Local model inference:** 15ms average
- **Cloud calls:** <5s when needed, hidden with UX
- **Cache hit rate:** 60%+ for common scenarios
- **Battery drain:** <1% per 30min gameplay

Business Sustainability

- **Cost per player:** \$0.12-2.70/month depending on tier
- **Essence profit margins:** 98-99% on premium content
- **Subscription margins:** 91-97% highly sustainable
- **Free player support:** Completely sustainable at scale

Implementation Checklist

Core Systems

- [] Player Character schema with OCEAN personality tracking
- [] Emotional capacity system (0-10 scale) with stressor management
- [] Four-tier memory architecture with resonance weighting
- [] Relationship progression (Levels 0-5) with NPC capacity tracking
- [] Skill system (30 skills) with capacity/OCEAN learning modifiers
- [] AI context system (7 layers) with token budget optimization

Master Truths v1.2 Compliance

- [] Numerical grounding: anchor-calculate-validate for all numbers
- [] Memory resonance: 5 weighted types with 3.0+ recall threshold
- [] Dramatic irony: 5-component scoring with 0.6+ usage threshold
- [] Capacity constraints: Support rule (capacity + 2) enforcement
- [] Novel quality: 150-200 word responses with behavioral grounding

Firestore Implementation

- [] Collection structure with proper indexing
- [] Security rules for data access control
- [] Optimization strategy (caching, compression, performance)
- [] Real-time sync for active gameplay data
- [] Background processing for novel generation

Conclusion

This data contract specification provides a complete architecture for LifeBond's multi-season life simulation system. The design prioritizes emotional authenticity, narrative continuity, and novel-quality storytelling while maintaining performance and business sustainability.

Key innovations include the four-tier memory system for multi-season continuity, NPC emotional capacity tracking for authentic relationships, memory resonance weighting for meaningful recalls, and comprehensive numerical grounding for all game mechanics.

The specification supports the core vision: NPCs that feel like real people, relationships with genuine emotional stakes, and a life simulation that creates memorable, literary-quality stories across multiple seasons of character development.

This specification complies with Master Truths v1.2 requirements and supports 8-10 season character lifecycles with full narrative continuity.