1. Informative Part

1.1 Team Composition

Managers: Gian Gonzalez, Kevin Lopez, Ricardo Perez

Fitness Tracker Team: Ernesto Soto (Team Leader), Cristian Massini, Pedro Matos, Cristian Barreras, Nelson Caban, Yandiel Hernandez, Luis Sorrentini, Michael Martinez

Foundations Team: Reinaldo Martinez (Team Leader), Estefania Roca, Lianette Alberto, Christian Rodriguez, Marcelo Perez, Christian Medina, Angel Ramos, Kevin Ibarra, Fernando Hidalgo

Game Design Team: Emmanuel Guadalupe (Team Leader), Aliana Santiago, Jorge Peralta, Keishlyany Sanabria, Diego Vazquez, Kiam Perez, Andrea Seda, Samael Alvarez

1.2 Current Situation, Needs, and Ideas

1.2.1 Current Situation

The current fitness-app landscape primarily offers simple workout loggers that behave like digital notebooks. These tools track sets and reps but provide little guidance, motivation, or meaningful feedback. As a result, many users—especially beginners—struggle to maintain consistency, losing interest because the app does not help them understand progress or stay engaged.

Additionally, without structured feedback, users often unknowingly overtrain some muscle groups while neglecting others. This creates imbalance, frustration, and potential injury risk. Existing apps rarely address this issue or provide insights beyond raw numbers.

Overall, the market lacks a motivating, engagement-driven tool that supports consistency, balanced development, and long-term adherence.

1.2.2 Needs

From stakeholder observations and early discussions, people engaging in fitness training need:

Motivation systems that reward consistency and reduce the repetitiveness of daily training.

Clear and intuitive visualizations that reflect progress beyond basic statistics.

Awareness of how often each muscle group is trained to avoid imbalances and injuries.

A sense of community, accountability, and comparison that supports long-term commitment.

These needs arise directly from fitness-journey challenges, including early frustration, difficulty maintaining habits, and the lack of immediate feedback.

1.2.3 Ideas

To address the identified needs, the following ideas emerged:

Introduce a gamified progress model with experience points, milestones, and achievement markers to reinforce consistency.

Provide a representation of muscle-group training balance so users can recognize strong and weak areas.

Offer intuitive progress summaries that highlight training frequency and volume across muscle groups.

Enable users to compare high-level training efforts with friends or peers to foster accountability and encouragement.

These ideas serve as early directions, not design decisions. They illustrate how the system-to-be could help users meet their fitness-related needs.

1.3 Scope, Span, and Synopsis

1.3.1 Scope and Span

This project lies within the domain of personal fitness training, motivation, and community-driven consistency. It aims to support users in understanding their own training behavior, maintaining balanced routines, and staying committed over time.

The scope includes identifying key stakeholders—beginners seeking direction, experienced gym-goers seeking balance, and socially motivated athletes—and studying their behavior to establish a domain representation. From these observations, requirements will be derived to ensure the system supports realistic training journeys.

The span of the project covers stakeholder analysis, domain modeling, requirements elicitation, and conceptual design. Any concrete technical decisions, implementation mechanisms, or UI structures fall outside the informative part and will be addressed later in the documentation.

1.3.2 Synopsis

Gamified Gym is envisioned as an application that promotes long-term engagement in fitness training by combining workout tracking with motivational and community-oriented concepts. The project follows an iterative development process supported by stakeholder input, domain research, and structured modeling techniques.

Its focus is on understanding the athlete’s training behavior, progress patterns, and social drivers behind consistency. The final goal is to represent the domain in a way that supports motivating, balanced, and sustainable fitness progress.

1.4 Other Activities Than Just Developing Source Code

Beyond coding, this project involves:

Domain Engineering: Understanding fitness behavior, training patterns, and motivational factors.

Requirements Engineering: Eliciting needs from stakeholders and translating them into clear system requirements.

Stakeholder Liaison: Communicating with fitness-interested individuals to validate domain findings and refine priorities.

Software Architecture: Structuring the conceptual design of the system-to-be.

Testing: Planning and conducting tests to ensure correctness, usability, and adherence to domain constraints.

Documentation & Analysis: Maintaining structured domain models, requirements, and conceptual descriptions throughout development.

1.5 Derived Goals

Primary Goal: Create an engaging, motivating fitness-support application that helps users stay consistent and maintain balanced training habits.

Secondary Goals:

Educational Value: Support users in understanding training principles such as balance, progression, and overuse awareness.

Community Building: Promote positive accountability and collective progress.

Domain Understanding: Capture the essential structures, behaviors, and motivational elements of real fitness journeys to inform later design.

2.1.1 Domain Rough Sketch (Raw Stories)

Raw Story: Losing Track During Supersets

Gym-Goer recounts: "I started a superset of dumbbell curls at 25 pounds and tricep pushdowns at 40 pounds. I wanted to complete three sets of each, but halfway through the first set of curls, I realized I hadn’t kept track of the warm-up reps.

The first few reps felt fine, but by the fourth rep, my forearms burned, and I paused because I couldn’t tell which set I was on. My grip felt shaky, and my breathing grew uneven.

On the next pushdown set, I tried to focus on the motion, but I kept losing focus and thinking about the earlier curls. I paused briefly, then started again. My arms tightened, and the movement became slower and less controlled.

I attempted another curl set, but my grip slipped slightly, and the movement became uneven. I lowered the dumbbells and stepped away, frustrated that I had lost track halfway through the session.

I moved on to a lighter machine row just to finish the workout, feeling mentally drained and unfocused."

Raw Story: Overreaching on Deadlift Day

Athlete recounts: "I started my deadlift session at 185 pounds, I wanted to push a little harder than last week. My legs and back were already sore, but I felt determined to lift more.

The first two reps felt manageable, but by the third, I noticed my lower back tightening. My grip started slipping slightly on the bar, and my breathing became uneven.

On rep four, I paused to reset my stance. My shoulders felt stiff, and the bar path wasn't straight. I paused for a moment before continuing, then I tried one more lift.

The next rep felt unstable, and I almost lost balance. I stopped immediately, feeling a sharp tension in my lower back. I stepped away from the bar, frustrated after feeling the sharp tightness in my lower back.

I decided to finish with lighter accessory exercises, feeling both sore and mentally exhausted."

Raw Story: Forgetting Previous Weights

Gym-Goer recounts: "I started bench press at 95 pounds. I hadn't tracked my previous workouts well, so I wasn't sure if this was my last working set or the one before.

The first few reps felt heavier than expected. I paused mid-set, I couldn't remember the previous weight I used. My breathing grew shallow as my focus drifted away from the lift.

On rep five, my elbows flared slightly, and my chest felt unusually fatigued. I paused again to think about whether I should continue with the same weight or adjust.

I tried one more rep, but the bar path wobbled slightly, and I felt my strength fading. I stopped early and moved to dumbbell flyes at a lighter weight, feeling frustrated because the session felt disorganized."

Raw Story: Cardio With Side Stitches

Athlete recounts: "I started on the treadmill at 5.5 mph. The first few minutes felt okay, but by minute three, I noticed a side stitch forming and my calves tightening. My breathing became shallow and irregular.

I tried to continue, but each step made the stitch worse, and my legs felt heavier with every stride. I slowed to a walk and held the rails for a few seconds, waiting to see if the stitch would ease.

I resumed jogging after a brief pause, but the pain returned almost immediately. My steps felt flat,

and my feet struck the belt harder than usual.

I stopped early, feeling frustrated that I couldn't maintain a steady pace. I walked slowly for a few minutes to recover, the tightness and heaviness where limiting my session."

Raw Story: Confused by Complex Routine

Gym-Goer recounts: "I started with incline dumbbell press at 65 pounds. My routine alternates between different rep schemes each week, and I paused, unsure which rep scheme I was supposed to follow.

The first few reps felt awkward, and I paused between reps trying to remember the plan. My shoulders burned quicker than expected, and my grip felt unstable.

On rep five, my right arm shook slightly, I wasn't sure if I was doing the right number of reps. I paused again, trying to recall the proper sequence.

I tried one more rep, but the weight felt heavier than expected, and my arms trembled. I stopped early and moved to lateral raises, feeling mentally tired from the confusion."

2.1.2 Terminology (Concepts Derived From Raw Stories)

Concept: Rep

Definition: A single, complete motion of an exercise, such as lifting and lowering a weight.

Observed in raw stories:

"The first few reps felt fine…"

"On rep five, my elbows flared slightly…"

"The first two reps felt manageable…"

Concept: Set

Definition: A group of consecutive reps performed without significant rest.

Observed in raw stories:

"I wanted to complete three sets of each…"

"I attempted another curl set…"

"I started my deadlift session… the first two reps…"

Concept: Grip

Definition: The way the hands hold a weight or equipment during an exercise.

Observed in raw stories:

“My grip felt shaky…”

“My grip slipped slightly on the bar…”

“My grip started slipping.”

Concept: Bar Path

Definition: The trajectory the barbell follows during a lift.

Observed in raw stories:

“The bar path wasn’t straight.”

“The bar path wobbled slightly…”

Concept: Tightness

Definition: A physical sensation of tension in muscles during an exercise.

Observed in raw stories:

“My calves tightening…”

“I noticed my lower back tightening…”

“My arms tightened…”

Concept: Fatigue

Definition: A decrease in muscle ability to continue producing force during an exercise.

Observed in raw stories:

“My chest felt unusually fatigued.”

“By the fourth rep, my forearms burned…”

“My legs felt heavier with every stride.”

Concept: Form

Definition: The physical technique used to perform an exercise, including posture and movement quality.

Observed in raw stories:

“The movement became uneven…”

“My elbows flared slightly…”

“My right arm shook slightly…”

Concept: Pause

Definition: A temporary stop in movement or exercise to regain control or reassess.

Observed in raw stories:

“I paused because I couldn’t tell which set I was on.”

“I paused to reset my stance.”

“I paused between reps…”

Concept: Side Stitch

Definition: A sharp abdominal or rib-area pain that occurs during running or cardio.

Observed in raw stories:

“I noticed a side stitch forming…”

“but each step made the stitch worse…”

Concept: Balance

Definition: The ability to maintain control and stability during a movement.

Observed in raw stories:

“I almost lost balance.”

“My steps felt flat…”

“the movement became uneven…”

Concept: Load

Definition: The amount of resistance used in an exercise, typically measured in pounds.

Observed in raw stories:

“I started bench press at 95 pounds.”

“I started my deadlift session at 185 pounds.”

“I started incline dumbbell press at 65 pounds.”

Concept: Breathing Pattern

Definition: The rhythm and control of breathing during exercise.

Observed in raw stories:

“My breathing became shallow and irregular.”

“My breathing grew uneven…”

“My breathing became uneven.”

Concept: Foot Strike

Definition: How the foot lands during running or treadmill exercise.

Observed in raw stories:

“My steps felt flat…”

“My feet struck the belt harder than usual…”

“Each step made the stitch worse…”

Concept: Loss of Focus

Definition: A moment during training when attention drifts away from the exercise, leading to interruptions, pauses, or inconsistent movement.

Observed in raw stories:

“I kept losing focus and thinking about the earlier curls.”

“I paused mid-set, I couldn’t remember the previous weight I used.”

“My focus drifted away from the lift.”

Concept: Decision to Stop Early

Definition: A point during an exercise where the athlete ends the set or movement before completion due to physical cues such as tightness, instability, or increasing difficulty.

Observed in raw stories:

“I stopped early and moved to dumbbell flyes…”

“I stopped immediately when the tension in my lower back increased.”

Concept: Form Instability

Definition: Irregular, uneven, or uncontrolled movement patterns during an exercise that indicate loss of technique quality.

Observed in raw stories:

“The movement became slower and less controlled.”

“The bar path wobbled slightly…”

“My right arm shook slightly…”

Domain Terminology in Relation to Domain Rough Sketch

The domain terminology was not taken directly from the raw stories. Instead, the raw stories in Section 2.1.1 were analyzed to extract recurring actions, sensations, and patterns observed during training sessions. These raw stories are unprocessed accounts, while the terminology in Section 2.1.2 represents refined concepts that emerged from examining those accounts.

For example, repeated mentions of “my grip slipped,” “my grip felt shaky,” and “my grip started slipping” were processed into the term Grip, with a precise definition that captures what the athlete is physically doing. Similarly, descriptions such as “the bar path wasn’t straight” and “the bar path wobbled slightly” led to the defined concept Bar Path.

Other terms — such as Tightness, Fatigue, Form, Loss of Focus, and Decision to Stop Early — were developed by grouping together multiple similar observations found across different raw stories. These definitions are not rough; they are the result of interpreting and refining what athletes repeatedly experienced.

Thus, Section 2.1.2 contains processed and clarified domain concepts, while Section 2.1.1 contains the unedited lived experiences that those concepts were derived from.

2.1.4 Narrative

Athletes begin a set with a chosen weight and rep plan, often feeling stable at first. Early repetitions may feel manageable, but instability quickly emerges: grip slips, bar paths wobble, and motions become uneven. As the set progresses, muscles tighten suddenly in the forearms, back, chest, or shoulders, and breathing grows shallow or irregular, disrupting rhythm.

Mid-set pauses are common, as athletes stop to reassess form, stance, or rep count. Confusion about previous loads or rep schemes interrupts the flow, leaving the athlete unsure whether to continue or adjust. Fatigue rises quickly, producing sensations of heaviness, burning, or trembling in specific muscles. Movements slow down, and instability or discomfort increases.

Athletes often attempt another rep after pausing, trying to regain control before stopping. But when strain escalates into sharp tightness, pain, or overwhelming fatigue, they frequently terminate sets early. They step away from the exercise, frustrated by the loss of control or disorganization. To finish the session, they switch to lighter weights, accessory machines, or slower pacing, seeking a manageable way to continue after instability or exhaustion.

This domain flow reflects how athletes operate under uncertainty, react to emerging sensations, and adjust mid-set. Training is rarely linear — it is shaped by interruptions, resets, and constant recalibration.

2.1.5 Events / Behaviors / Functions

Pattern: Losing Control During Movement

Events & Behaviors (with raw-story quotes)

GripSlips

“my grip slipped slightly”

BarDoesNotMoveStraight

“the bar path wasn’t straight” “the bar path wobbled slightly”

MovementSlowsUnexpectedly

“the movement became slower”

ArmShakesDuringLift

“my right arm shook slightly”

FootStrikeBecomesFlat

“my feet struck the belt harder than usual”

Domain Functions (based on actual athlete reactions)

steadyGrip() → ImprovedGrip Justified by: multiple attempts to regain hold after grip becomes shaky.

slowDownMovement() → MovementState Justified by: athlete reduces pace when movement becomes unstable.

resetMovementPath() → PathStatus Justified by: athlete pauses and resets stance when bar drifts.

Pattern: Fatigue and Tightening

Events & Behaviors (with quotes)

ForearmsBurn

“my forearms burned”

LowerBackTightens

“my lower back tightening”

CalvesTighten

“my calves tightening”

BreathingBecomesShallow

“my breathing became shallow and irregular”

SideStitchAppears

“a side stitch forming”

Domain Functions (matching actions taken)

pauseBecauseOfTightness() → RecoveryState Justified by:

“I slowed to a walk and held the rails…”

adjustEffortDueToFatigue() → EffortLevel Justified by:

“the movement became slower and less controlled”

stopDueToTension() → StopOutcome Justified by:

“I stopped immediately when the tension increased”

Pattern: Losing Track or Forgetting

Events & Behaviors (with quotes)

RepCountLost

“I couldn’t tell which set I was on”

WorkingWeightUncertain

“I wasn’t sure if this was my last working set”

RepPlanUnclear

“unsure which rep scheme I was supposed to follow”

AttentionShiftsAway

“my focus drifted away from the lift”

PauseToRecollect

“I paused again to think”

Domain Functions (as actually done by athlete)

pauseToRecollectPlan() → PlanStatus Justified by:

“paused between reps trying to remember”

checkPreviousWeight() → WeightRecollection Justified by:

“I paused mid-set, I couldn’t remember the previous weight I used.”

restartSetAfterConfusion() → SetStatus Justified by:

“I paused briefly, then started again”

Pattern: Stopping or Slowing Mid-Session

Events & Behaviors (with quotes)

AthleteSlowsDown

“I slowed to a walk”

AthletePausesSet

“I paused mid-set”

SetEndsBecauseOfInstability

“I stopped early”

DecisionToStopAfterPain

“I stopped immediately when the tension increased”

SwitchToLighterMovement

“I moved to dumbbell flyes at a lighter weight”

Domain Functions (matching next-step actions)

slowDownPace() → PaceLevel

stopSetEarly() → SetOutcome

switchToLighterMovement() → ExerciseChoice

Pattern: Changing Exercise Mid-Session

Events & Behaviors

SwitchToAccessoryExercise

“I decided to finish with lighter accessory exercises”

TransitionToMachine

“I moved on to a lighter machine row”

ChangeExerciseAfterConfusion

“I stopped early and moved to lateral raises”

ChangeExerciseAfterInstability

“I moved to dumbbell flyes”

Domain Functions

changeExercise() → Exercise

chooseEasierExercise() → Exercise

transitionToMachineWork() → Exercise

===2.1.6 Function Signatures

Pattern: Losing Control During Movement

steadyGrip(grip: Grip): Grip slowDownMovement(movement: Movement): Movement resetMovementPath(path: MovementPath): MovementPath

Pattern: Fatigue and Tightening

pauseBecauseOfTightness(tightness: Tightness): RecoveryState adjustEffortDueToFatigue(fatigue: Fatigue): EffortLevel stopDueToDiscomfort(discomfort: Tightness): StopOutcome

Pattern: Losing Track or Forgetting

pauseToRecollectPlan(plan: RepPlan): PlanStatus checkPreviousWeight(load: Load): WeightRecollection restartSetAfterConfusion(set: Set): SetStatus

Pattern: Stopping or Slowing Mid-Session

slowDownPace(pace: Pace): Pace stopSetEarly(set: Set): SetOutcome switchToLighterMovement(exercise: Exercise): Exercise

Pattern: Changing Exercise Mid-Session

changeExercise(current: Exercise): Exercise chooseEasierExercise(exercise: Exercise): Exercise transitionToMachineWork(exercise: Exercise): Exercise

2.2 Requirements

We categorize all system requirements into four groups: **Domain**, **Functional**, **Interface**, and

Machine. Each requirement is also assigned a priority level (**High**, **Medium**, or **Low**) to indicate its importance for the first release.

The primary requirements defined for this project include: * **Workout Logging** – High * **XP System** – High * **Saved Workouts** – Medium * **User Accounts** – High * **Schedule / Planning** – Medium * **Achievements** – Medium * **Notifications** – Low

2.2.2 Personas

- Alex, the Beginner:
  - Background and daily habits: Alex is a 28-year-old office worker from Miami, Florida. He works long hours at a marketing firm and often ends the day feeling drained. Outside of working hours, he enjoys cooking simple meals, listens to podcasts about technology and entrepreneurship, and occasionally playing casual mobile games to relax. Alex is new to fitness and often feels overwhelmed and feels out of place in a public gym, unsure of where to start or whether he is making any progress. His primary goal is to build a consistent workout habit to improve his health, energy levels, and overall well-being, as he feels sluggish from sitting all day at the office. His colleagues discussing fitness apps during lunch influences his desire for a polished, engaging user experience, which he might feel confident enough to share once he sees progress. Alex is motivated by music and likes to listen to high-energy playlists on Spotify during workouts to stay focused. He is curious, eager to learn, and wants clear guidance to help him feel confident and prevent unnecessary injuries as he begins his fitness journey.
  - Motivations and goals: Alex isn't just trying to "build a habit." He wants to improve his energy levels to be more effective at his marketing job and eventually perhaps start his own business.
  - Pain points and needs: The team will realize the app isn't just a fitness tool, but a stepping stone to entrepreneurial success and better time management, making features like progress visualization extremely important for tracking overall life progression, not just reps. Gym Anxiety, this suggests he would benefit from a "solo mode" or privacy settings initially. Alex's interest in cooking simple meals suggests he might appreciate a section in the app with quick, easy-to-follow healthy recipes that fit into his busy evenings. Alex interest in listening to music during workouts present expectation of seamless integration with existing tools like Spotify or other tools. Current fitness apps only log data but fail to provide engaging feedback or build motivation. Alex struggles to understand fitness terminology and is unsure if his training is balanced, leading to a fear of developing imbalances or injuring himself by overdoing certain exercises. Additionally, he prefers features that fit into busy, irregular schedules and offer clear visual rewards. He needs an intuitive, encouraging, and gamified guide to help him build a foundation.
- Diego, the Competitive Gamer:
  - Background and daily habits: Diego is a 22-year-old computer science student from San Juan, Puerto Rico. He spends much of his free time gaming, streaming, or coding with friends online. He loves competitive environments and progression systems, whether it's climbing ranked ladders in his favorite games or improving his game stats. Outside of gaming Diego enjoys testing with his friends who have more strength, endurance, or who can make the best dish, but he feels weaker than them in physical challenges. His feeling of

being physically weaker than friends isn't just about gym stats; it's about social confidence and status within his friend group. Looking information online he stumbled across how improving physical strength might also be linked to improving focus for long coding sessions and started to consider going to the gym. Although he joined a gym last semester, he quickly lost motivation because he doesn't get the feeling of achieving, often translating to a feeling of wasted time.

    - Motivations and goals: Diego wants a fitness app that makes working out feel like leveling up in a video game. He is motivated by points, rankings, and visual progress bars that show him getting stronger in real time. His main goal is to stay consistent by turning workouts into daily "missions" that reward effort and let him compete with friends. He also wants to improve his physical strength so he can win physical challenges against his friends.
    - Pain points and needs: The app's competitive elements need to be robust enough to help him earn bragging rights, not just personal points. Competition against his friends is a major motivator. The app needs highly developed social challenge features, perhaps customizable duels or guild-like team goals, not just a simple leader board. Current gym apps feel lifeless to him; they only track sets and reps without giving a sense of reward or excitement. He struggles with accountability when training alone and needs an app that transforms progress into a fun, measurable system that keeps him hooked like a game. He also wants an app that provides clear, visual indicators of his improvements as if he is improving stats in a game. His computer science background suggests he is comfortable with technology and likely expects a sophisticated, bug-free, and well-designed interface, not a basic app.

- Sarah, the Consistent:
    - Background and daily habits: Sarah is a 32 year old teacher from Austin, Texas, who has maintained a regular gym routine for the past two years. She teaches high school health and wellness classes, and her curiosity about nutrition, fitness, and exercise science allows her to apply what she learns both in school and in her personal life. She is knowledgeable about basic exercises and tracks her sets and reps diligently in a notes app. She enjoys the discipline of training and typically works out early in the morning before school to maintain consistency. Outside the gym and school, Sarah enjoys reading about nutrition and wellness, trying out new healthy recipes, and occasionally attending local fitness classes to expand her knowledge. As a busy teacher, time is precious and likes to plan ahead during the week. She secretly allows herself a cheat day every two weeks, indulging in foods like Burger King or fully loaded pizzas. As a health teacher, hitting a plateau has been slightly embarrassing or frustrating for Sarah because she feels she "should" know better. She suspects she may be neglecting certain muscle groups but lacks the data to confirm it.
    - Motivations and goals: Her goal isn't just about lifting heavier weights; it's about a continuous quest for knowledge and mastery of health and wellness. Sarah wants to optimize her training to overcome her current progress plateau. She is motivated by measurable results and personal challenges, using data to track improvements and hold herself accountable. Her main goal is to ensure balanced development across all muscle groups while adding a new layer of challenge and enjoyment to her well-established fitness routine, beyond simply lifting heavier weights.
    - Pain points and needs: Sarah has hit a progress plateau and feels her workouts have become repetitive. She suspects she may be neglecting certain muscle groups but lacks the data to confirm it. Her current tracking method is fragmented and offers no actionable insights. She

finds most fitness apps too simplistic and not designed for someone with her experience and discipline. She needs a tool that provides detailed, data driven analytics on her performance and muscle development. Her structured schedule suggests the need for features that allow for advanced planning, such as a robust weekly or monthly workout scheduler that can send calendar reminders to her work schedule.

- Marcos, the Motivator:
  - Background and daily habits: Marcos is a 24-year-old graduate student from Chicago, Illinois, who treats fitness as a social activity. He works out with a close-knit group of friends, relying on their presence for accountability and friendly competition. Marcos and his friends constantly challenge each other to show up and push harder. He often shares workout milestones on social media like, Instagram but wishes there were a more integrated way to track his progress and stay connected with his friends' achievements. Outside the gym, Marcos balances his studies, part-time tutoring, and social life. He enjoys attending local fitness events, trying new workout classes, and exploring healthy restaurants with friends. He is curious about sports science and occasionally reads articles on training techniques and recovery methods. Although disciplined, he sometimes struggles to stay consistent when friends are unavailable or during particularly busy weeks, which makes him value social accountability even more. Marcos also enjoys mentoring others in fitness and often motivates classmates or peers to adopt healthier habits. He sees exercise not just as a personal goal but as a way to connect with others, challenge himself, and maintain a sense of structure in his life.
  - Motivations and goals: Marcos primary motivation is community, accountability, and shared achievement. He wants an app that strengthens his workout group's connection by making it easy to share progress, celebrate each other's accomplishments, and maintain streaks together. He thrives in a positive, friendly competitive environment that emphasizes consistency and effort rather than solely focusing on raw strength. Beyond personal improvement, Marcos also wants to inspire and motivate others, helping peers adopt healthier habits while enjoying a sense of community and shared challenge.
  - Pain points and needs: Marcos already uses Instagram for sharing. The app needs highly polished, shareable visual summaries of achievements that are optimized for social platforms, leveraging his habit to attract new users and enhance existing engagement. There is no seamless way to create a private leaderboard with just his friends to track consistency, celebrate milestones, and encourage each other. He struggles to stay motivated when his workout group is unavailable and wants a platform that fosters a small, supportive community centred around collective growth. The pain of friends being unavailable isn't just about missing a workout; it's about feeling isolated. Mentoring others in fitness gives Marcos a sense of purpose. The app could integrate a "mentor mode" or a public "coach profile" where he can track the progress of those he mentors, reinforcing his role as a leader and motivator. His focus on positive competition and motivation suggests that gamification should prioritize "praise" and "high-fives" alongside raw ranking data. Features might include a robust set of positive reaction emojis or automated encouragement messages.

2.2.3 Domain Requirements

Principles

- Fitness as a Journey of Personal Progress
  - Improvement in strength, endurance, and consistency is a core driver of motivation. The system shall provide a mechanism with clear, quantifiable metrics and visual representations of a user's progress over time.
  - A balanced approach targeting all major muscle groups is essential for preventing injury and achieving a well-rounded physique. The system shall provide a mechanism that facilitate and encourage awareness of training distribution across the body.
- Engagement with Fitness Training
  - Long-term consistency requires more than initial novelty. The system shall implement a layered reward structure (e.g., XP, achievements, ranks) that provides continuous feedback and celebrates milestones of varying difficulty.
  - Fitness journeys can be reinforced through community. The system shall provide a mechanism for positive social comparison and mutual support that focuses on shared effort and consistency.

Functional Requirements

- Workout Logging **The system shall provide an interface for the user to log an exercise by specifying the exercise name, weight lifted, number of sets, and number of repetitions per set.
- Progress Tracking
  - The system shall calculate and display a historical graph of the total training volume (weight × sets × reps) for each muscle group over a user-selectable time period.
  - The system shall provide a mechanism that tracks and highlights new Personal Records (PRs) when a user logs a set with a higher weight for a given exercise than any previous set.
  - The system shall provide a mechanism that suggest alternative exercises during the logging process if the user's current selection disproportionately targets an already dominant muscle group based on the "Muscle Balance Score".
  - The system shall provide a mechanism for the users to input goals based on specific timeframes and automatically generate a structured, periodized workout plan toward that goal.
  - The system shall provide a mechanism for users to publicly share "milestone posts" when achieving significant achievements to facilitate positive social reinforcement.
  - The system shall provide a mechanism that detects a performance plateau, the system shall provide automated suggestion to changes in repetition ranges.
- Gamification System
  - The system shall provide a mechanism that assigns a user a rank (Bronze, Silver, Gold, etc.) for each muscle group, calculated based on the total historical training volume and PRs for that muscle group.
  - The system shall provide a mechanism that awards users experience points (XP) for completing workouts and achieving milestones.

2.2.5 Machine Requirements

- The system shall maintain an average response time of no more than 2 seconds for user interactions, such as updating activity data under normal operating conditions. In the event of a search query, the system shall return data retrieval operations within 4 seconds, even during peak usage.
- The system shall run under normal conditions, when concurrently running 300 user interactions that all randomly start within a 5 minute interval. Beyond this threshold, the system shall gracefully degrade its performance, prioritizing essential functionalities such as the viewing workout history and submitting of exercise logs.
- The system shall gracefully handle an increase when concurrently running 100 user interactions at any given time by dynamically allocating resources. Beyond this threshold, new user connections shall be queued, and the system shall restrict additional connections until resources become available.
- The system shall process and store a standard 3-set exercise log within 2 seconds of submission.

2.3 Architecture Overview

The conceptual architecture is organized into four subsystems, each aligned with a specific group of aggregates and domain responsibilities. Each subsystem protects its own invariants and emits domain events that other subsystems may consume.

Subsystem boundaries are defined by:

- which **aggregates** and **domain concepts** they own,
- which **invariants** they protect,
- and which **information they expose** to other subsystems.

The main conceptual subsystems are:

- Training & Sessions
- Progress & Gamification
- Social Motivation
- Athlete Registry

2.3.1 Core Subsystems and Responsibilities

The conceptual architecture is organized into four subsystems, each aligned with a specific group of aggregates and domain responsibilities. Each subsystem protects its own invariants and emits domain events that other subsystems may consume. Subsystem boundaries are defined not only by ownership of aggregates, but also by the invariants each subsystem enforces and by what is not allowed to cross the boundary.

Training & Sessions Subsystem

Owned aggregates (examples): - `WorkoutSession` (root), containing `ExerciseEntry`, `SetEntry`, rest

periods, and session-level metadata. - Conceptual structures used to represent planned sessions or routines, where applicable.

Responsibility: - Define and manage the structure of workouts and training sessions. - Plan and organize training sessions toward given goals (structuring a session or routine based on a training goal). - Manage the lifecycle of a workout session: - Beginning a session. - Choosing exercises. - Recording sets, rest, and completion.

Key invariants enforced: - A workout session has a valid chronological sequence of actions (no negative time, no "end" before "begin"). - Every recorded set belongs to a chosen exercise within that session. - Reps, weight, and intensity values obey domain constraints (non-negative quantities, valid intensity ranges).

Domain events emitted: - **Exercise Completion Event**: triggered when an athlete completes a set or repetition. - **Workout Completion Event**: triggered when all planned exercises in a workout session are finished. - **Personal Best Event**: emitted when session performance surpasses previous records.

Exposed information: - Structured training evidence (sets, exercises, volumes, muscle-group involvement). - Session-level summaries and events describing what actually happened during training.

Boundary constraints (what cannot cross this boundary): - External subsystems cannot directly mutate `WorkoutSession` or its internal entities. - Training-specific structures (raw `ExerciseEntry` and `SetEntry`) are not exposed for modification outside the subsystem; external consumers only see read-only evidence or summaries. - Progress or social metrics (XP, ranks, relative standings) must not be defined inside Training & Sessions.

Progress & Gamification Subsystem

Owned aggregates (examples): - `AthleteProgress` (root), including: - XP totals. - Level. - Streak state. - Collections of `Achievement` or `Milestone`.

Responsibility: - Interpret training evidence produced by Training & Sessions and maintain long-term progress representations. - Apply progression rules and enforce invariants, such as: - XP accumulation and scaling rules. - Achievement unlock conditions. - Streak continuity and reset conditions. - Analyze historical training data to detect domain-relevant patterns: - Shifts in muscle balance. - Performance plateaus. - Consistency trends. - Produce domain-level progress facts needed by other subsystems.

Key invariants enforced: - XP totals cannot decrease arbitrarily; changes follow defined progression rules. - Achievements and milestones cannot be unlocked unless their domain criteria are satisfied. - Streaks are calculated according to consistent time windows and cannot be "patched" manually. - Muscle balance and plateau detection follow stable, documented rules.

Domain events emitted: - **Achievement Unlocked Event**: emitted when accumulated progress meets the criteria for a milestone. - **Overtraining Warning Event**: emitted when long-term patterns indicate unhealthy imbalance or excessive fatigue. - **Personal Best Event**: may also be re-emitted or interpreted to update long-term progress (if applicable to the domain logic).

Exposed information: - Abstract progress metrics (XP, level, streak length, achievement states). - Muscle balance indicators and other derived insights as domain facts.

Boundary constraints (what cannot cross this boundary): - Raw training structures (`WorkoutSession`, `ExerciseEntry`, `SetEntry`) are not stored or mutated here; they are only interpreted as evidence. - UI-specific notions (screens, feeds, visualizations) are not modeled in this subsystem. - Social comparison structures (leaderboards, relative positions) are not owned here; they belong to Social Motivation.

Dependencies: - Consumes training evidence and events from the Training & Sessions subsystem. - Does not plan or structure workouts (those responsibilities remain in Training & Sessions).

Social Motivation Subsystem

Owned aggregates (examples): - `Leaderboard` (conceptual aggregate representing comparative performance data). - Social comparison structures such as `AthleteComparisonSet` or other domain constructs capturing which athletes are being compared and by what criteria.

Responsibility: - Maintain domain-level structures that support social comparison and accountability. - Track comparison-relevant groupings and relations among athletes (sets of athletes being compared under a specific rule). - Produce rank-relevant domain facts, such as: - Relative positions within a comparison set according to defined metrics. - Changes in relative ordering when progress or consistency changes. - Enforce comparison invariants: - Comparison metrics must be based on well-defined progress data. - Ties and ranking rules are consistently applied.

Key invariants enforced: - Each leaderboard or comparison structure is built on a clearly defined metric (XP, streak length) and time window. - Relative ordering is consistent with that metric (no contradictions such as two different athletes occupying the same rank without a tie rule). - Only athletes belonging to a given comparison set are included in its ranking.

Domain events emitted: - **Achievement Unlocked Event**: reused contextually when an unlocked achievement is relevant to comparison structures. - **Personal Best Event**: reused when relevant for group-level performance comparison.

(Note: the Social subsystem does not introduce new domain events; it reinterprets existing ones in a comparative context.)

Exposed information: - Abstract comparative metrics, such as: - Athlete ordering within a defined comparison set. - Rank positions and changes in rank. - Comparison-relevant state (“this athlete is above/below another according to metric X”).

Boundary constraints (what cannot cross this boundary): - Social Motivation does not store or mutate `AthleteProgress` or `WorkoutSession` aggregates. - UI concepts such as posts, feeds, or visual layouts are not modeled here. - Identity details beyond the `AthleteId` and comparison-relevant facts are not managed here; those remain in Athlete Registry and other subsystems.

Dependencies: - Consumes progress-related facts (XP, levels, achievements, streaks, muscle balance indicators) from Progress & Gamification. - May consume high-level training summaries from Training & Sessions when relevant for comparison logic.

Athlete Registry Subsystem

Owned aggregates (examples): - `Athlete` as the root entity representing a person who trains, with stable identity and profile attributes.

Responsibility: - Act as the canonical source of athlete identity in the domain. - Maintain invariants such as: - Every athlete has a unique `AthleteId`. - Profile and configuration attributes respect domain constraints. - Provide identity and static attributes used by other subsystems to associate training, progress, and social structures to specific athletes.

Key invariants enforced: - No duplicate identities (unique `AthleteId` per athlete). - Identity is stable over time; other subsystems cannot reassign events from one athlete to another arbitrarily. - Only valid, domain-accepted attribute values are stored in the athlete profile.

Domain events emitted: - **(None of the five defined events originate from Athlete Registry.)**

(Registry may reference events but does not emit them, consistent with its identity-only role.)

Exposed information: - `AthleteId` and stable profile attributes required for other subsystems to bind their aggregates and events to the correct athlete.

Boundary constraints (what cannot cross this boundary): - Other subsystems cannot change `Athlete` identity or profile data directly; they can only reference athletes via `AthleteId`. - Training, progress, or social-specific state is not stored in Athlete Registry.

Dependencies: - Conceptually independent of Training & Sessions, Progress & Gamification, and Social Motivation. - Serves as a foundational subsystem referenced by all others.

2.3.2 Boundaries and Information Flows

Subsystem interactions follow strict, directional boundaries. The goal is to prevent cyclic dependencies while allowing higher-level abstractions to build on lower-level evidence. In addition to directional dependencies, each boundary defines what must not cross it and where translation/anti-corruption occurs.

1. **Ownership, Invariants, and Isolation**

Each subsystem owns its aggregates and enforces its invariants:

- Only **Training & Sessions** may alter `WorkoutSession` and training structures.
- Only **Progress & Gamification** may alter `AthleteProgress` and its embedded progress state.
- Only **Social Motivation** may alter `Leaderboard` and other social comparison aggregates.
- Only **Athlete Registry** may alter `Athlete`.

Other subsystems may read high-level domain facts or summaries, but they cannot directly mutate aggregates owned by another subsystem. This enforces a clear **anti-corruption boundary**: no subsystem is allowed to “reach inside” another subsystem’s aggregates and bypass its invariants.

1. **Flow of Information: From Concrete Evidence → Derived Insights → Social Comparison**

Training & Sessions → Progress & Gamification

- Training & Sessions produces concrete training evidence in the form of:
- Completed sets and exercises.
- Session summaries (training volume, muscle group participation).
- Events such as `AthleteCompletesSet`, `AthleteEndsWorkoutSession`, `PersonalRecordAchieved`.
- Progress & Gamification consumes this evidence to:
- Adjust XP and level.
- Update streaks.
- Unlock achievements.
- Detect shifts in muscle balance or plateaus.

Anti-corruption / translation at this boundary: - Raw training structures (`WorkoutSession`, `ExerciseEntry`, `SetEntry`) are translated into neutral **evidence objects** or event payloads before entering Progress & Gamification. - Progress & Gamification does not manipulate `WorkoutSession` directly; it operates on a translated representation that is stable for its own invariants.

Progress & Gamification → Social Motivation

- Progress & Gamification produces progress facts such as:
- Current XP and level.
- Achievement and milestone states.
- Streak lengths.
- Balance or plateau indicators.
- Social Motivation consumes these progress facts to:
- Construct and maintain comparison sets and rankings.
- Determine when relative positions change and emit events like `RelativeRankChanged`.

Anti-corruption / translation at this boundary: - `AthleteProgress` is not exposed as a mutable aggregate to Social Motivation. - Instead, Social Motivation receives derived metrics (XP values, streak lengths, achievement counts, etc.) in a form adapted to its comparison rules. - Social Motivation's comparison structures (`Leaderboard`) are built from these metrics, not from direct references to `AthleteProgress`.

Training & Sessions → Social Motivation

- When necessary for comparison, Social Motivation may also consume high-level training summaries such as:
- Number of recent sessions in a time window.
- Presence of recent personal records.

Anti-corruption / translation at this boundary: - Social Motivation does not work with raw training aggregates; it uses translated summaries or events that encode only the information

needed for comparison.

1. **Role and Boundaries of Athlete Registry**
    - Every subsystem uses `AthleteId` from Athlete Registry to associate its aggregates and events with a specific athlete.
    - Athlete Registry does not depend on other subsystems; it is a foundational reference point rather than a consumer of training, progress, or social state.

Anti-corruption aspects: - No subsystem may invent or reinterpret athlete identity; they must use the `AthleteId` and attributes exposed by Athlete Registry. - Mapping from external identifiers (user accounts in the outer world) to `AthleteId` happens through translation layers outside the domain subsystems; inside the domain, `AthleteId` is the stable reference.

Conceptual Summary

Overall, the subsystems form a conceptual pipeline:

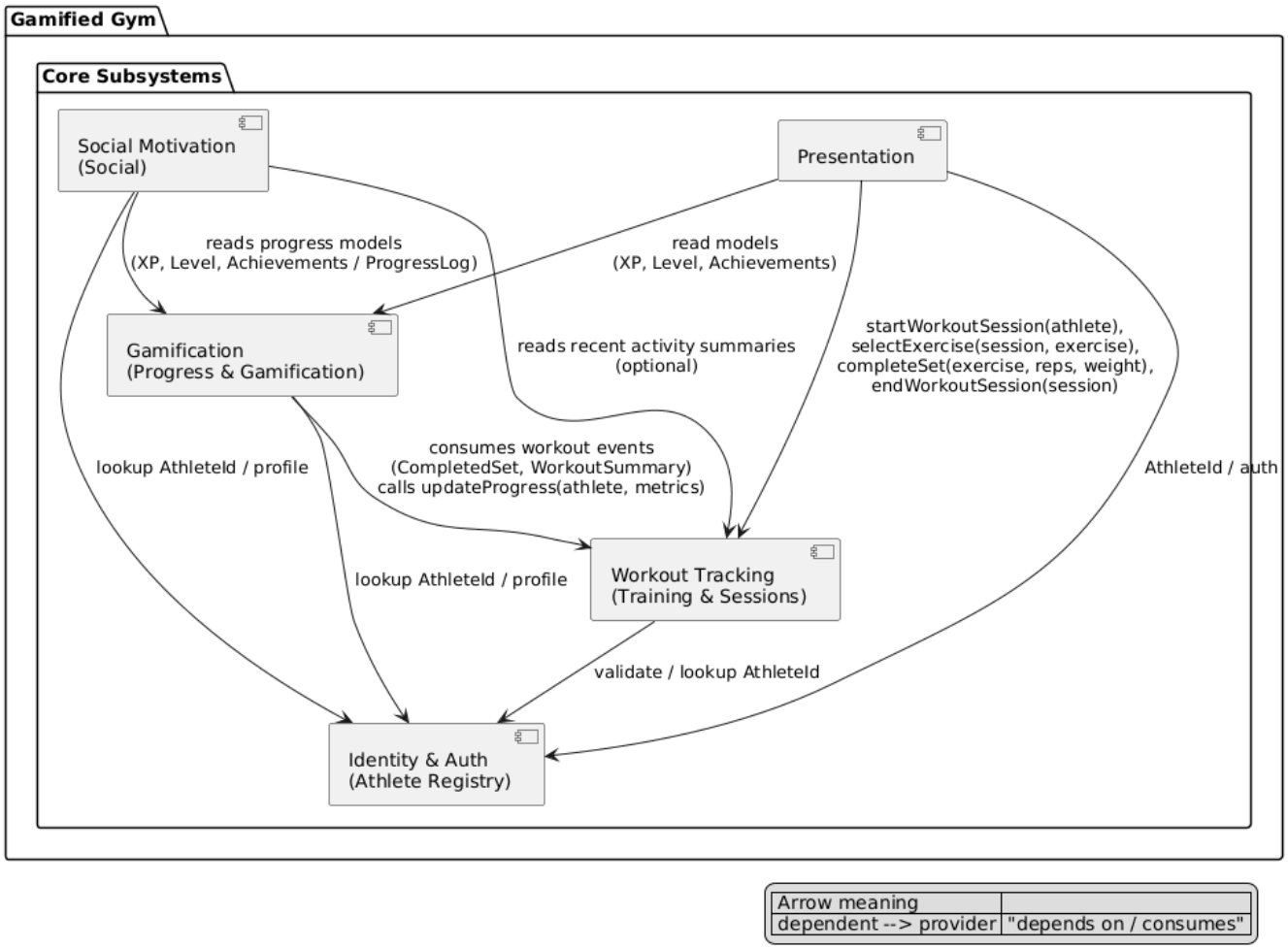
- **Training & Sessions** provides **concrete evidence** about what the athlete actually did.
- **Progress & Gamification** converts that evidence into **interpreted, long-term insights** about the athlete's journey.
- **Social Motivation** uses those insights (and, when needed, high-level training summaries) to derive **social comparison structures** that describe how athletes relate to each other.
- **Athlete Registry** underpins all of this with stable identity, ensuring that every event, aggregate, and comparison is consistently tied to the correct athlete.

Subsystem boundaries are enforced through:

- Strict ownership of aggregates and invariants.
- Directional dependencies.
- Translation and anti-corruption layers between subsystems so that no aggregate is modified outside its owning subsystem and no boundary is crossed with raw, uncontrolled structures.

2.3.3 Conceptual Architecture Diagram

The diagram below illustrates the conceptual boundaries and dependency directions between subsystems. Arrows indicate which subsystem **depends on** another and what kind of information it consumes.


Gamified Gym
Core Subsystems
Social Motivation
(Social)
Presentation
reads progress models
(XP, Level, Achievements / ProgressLog)
read models
(XP, Level, Achievements)
Gamification
(Progress & Gamification)
reads recent activity summaries
(optional)
startWorkoutSession(athlete),
selectExercise(session, exercise),
completeSet(exercise, reps, weight),
endWorkoutSession(session)
lookup AthleteId / profile
consumes workout events
(CompletedSet, WorkoutSummary)
calls updateProgress(athlete, metrics)
AthleteId / auth
lookup AthleteId / profile
Workout Tracking
(Training & Sessions)
validate / lookup AthleteId
Identity & Auth
(Athlete Registry)
Arrow meaning
dependent --> provider
"depends on / consumes"