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1 Solution Outline

1.1 Document Map

- [Objectives](#)
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2 Solution Outline

2.1 Introduction

Purpose: Provide a single, authoritative architecture narrative for the Sports Booking Platform initiative, suitable for business and delivery stakeholders.

Scope: High-level design and decision framework; not detailed design. Where information is unknown, it is captured explicitly under **Assumptions and Conditions** or as open points.

2.1.1 How to use this document

- This document is generated from and maintained in alignment with the **Objectives** document and validated **C4 Architecture Diagrams**.
 - Sections are included only when supported by Objectives and validated artifacts. Gaps and open points are recorded under **Assumptions and Conditions**.
 - Content is vendor-neutral unless objectives or constraints explicitly mandate a specific platform or product.
 - Every major statement is traceable to one or more sources: Objectives, Requirements Inventory, validated diagrams, or documented assumptions.
 - Reference the validated diagrams explicitly when describing system boundaries and logical structure.
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2.2 Overview and Context

2.2.1 Business Context and Drivers

Today, sports activity organization suffers from fragmentation across informal communication channels, manual coordination, and disconnected systems. Players, coaches, and venue owners rely on phone calls, messaging applications, and spreadsheets to arrange training sessions, matches, and tournaments. This fragmentation creates limited visibility of availability, inefficient scheduling, frequent conflicts, and lack of reliable data for planning and optimization.

2.2.2 Transformation Goal

The initiative seeks to introduce a unified digital platform that acts as a central hub for sports activity management, simplifying participation, scheduling, and management while supporting scalability and future ecosystem growth.

2.2.3 Target Outcomes and Success Criteria

The platform is designed to achieve the following business outcomes:

- **Unification and Coordination** – Establish a single, trusted platform where players, coaches, and venue operators can coordinate sports activities instead of relying on informal channels. This resolves fragmentation and enables reliable, consistent information flow across all stakeholders.
- **Visibility and Efficiency** – Provide near real-time visibility of availability, activity schedules, and participation status, reducing scheduling conflicts and enabling data-driven planning and growth opportunities.
- **Accessibility and Simplicity** – Enable end users to register, discover activities, manage participation, and coordinate seamlessly through digital channels without manual intervention or external coordination.

- **Scalability and Extensibility** – Build a foundation that supports growth across additional sports, advanced scheduling rules, and integrations with external services as the organization evolves.

2.2.4 In Scope and Out of Scope

2.2.4.1 In Scope

The platform provides the following business capabilities:

- **User Management** – Digital registration, profile creation, and identity management for all participant roles (players, coaches, venue operators, administrators) with support for role-based access and permissions.
- **Venue Management** – Centralized management of sports venues, including basic facility information, location details, and availability schedules that reflect current booking and operational status.
- **Activity Lifecycle** – Creation, publication, and management of training sessions, matches, and multi-session tournaments with support for defining participation rules and capacity constraints.
- **Activity Discovery and Booking** – Online discovery and booking of available activities by participants, with visibility of activity details, capacity, and booking status until activity capacity is reached.
- **Participation Management** – Management of participation status, confirmations, cancellations, and participant notifications throughout the activity lifecycle.
- **Historical and Upcoming Visibility** – Visibility into current activity schedules, upcoming activities, and historical records for all user roles to support planning and analysis.
- **External Integrations** – Integration capability with external payment providers for optional online payments, and with notification services to inform users about bookings, changes, and cancellations.

2.2.4.2 Out of Scope

The platform does not include:

- Detailed financial management, billing, or revenue sharing operations (though payment integration is provided as a capability for future use).
- Competitive ranking, tournament scoring, or results management beyond basic multi-session event coordination.
- Direct management of operational responsibilities, support ticket systems, or internal maintenance workflows.
- Offline modes or mobile-specific features beyond basic web/mobile channel access.

2.2.5 Key Stakeholders

- **Players** – End users seeking to discover and participate in training sessions, matches, and tournaments. Primary consumers of discovery and booking capabilities.
- **Coaches** – Activity organizers who create and publish training sessions, coordinate participant enrollment, and oversee activity execution.
- **Venue Owners and Operators** – Facility managers responsible for managing venue information and maintaining availability schedules.
- **Platform Administrators** – Internal users responsible for operational oversight, system configuration, and governance rule definition.
- **External Partners** – Payment service providers and notification services that integrate with the platform.

2.3 Assumptions and Conditions

2.3.1 Assumptions

The following conditions are assumed due to missing or ambiguous inventory information:

1. **Eligibility Rules** – “Eligible participants” are referenced but specific eligibility criteria (skill level, registration requirements, prerequisites) are not defined. These rules will be clarified by stakeholders during detailed specification phases.
2. **Booking Conflict Policies** – The platform must handle booking conflicts when venue availability changes after activities are scheduled. Specific business policies for conflict resolution (re-accommodation, cancellation, notification) require stakeholder input.
3. **Cancellation and Refund Rules** – Cancellation workflows and refund policies for both coaches canceling activities and participants canceling bookings are open business policies requiring clarification.
4. **Waitlist Management** – Whether the system should maintain waiting lists when activity capacity is reached will be clarified during detailed specification.
5. **Real-Time Latency Thresholds** – “Near real-time” visibility is required but acceptable latency thresholds (seconds/minutes) will be specified during non-functional requirements refinement.
6. **Tournament Governance** – Multi-session tournaments are included but governance rules, participation entry requirements, and competitive rules will be specified by stakeholders.
7. **Data Retention and Archival** – Historical data retention periods and archival strategies will be clarified based on regulatory and business requirements.
8. **Payment Model** – Payment integration is optional and the specific payment model (direct payment, escrow, platform fee handling) will be clarified during specification.
9. **Notification Channels** – Specific notification channels (email, SMS, push) and delivery guarantees will be defined based on user preferences and integration capabilities.
10. **Regulatory Compliance Scope** – Data protection requirements depend on deployment geography. Compliance requirements will be clarified based on intended deployment scope.

2.3.2 Constraints

The following constraints limit solution options:

1. **Cloud-Based Deployment** (REQ-23) – The platform must be hosted in a cloud environment. Specific cloud provider, regions, and service model (SaaS, PaaS, IaaS) are not prescribed by requirements.
2. **Independent Scaling** (REQ-24) – The platform architecture must support independent scaling of different functional areas to accommodate growth without redesign.
3. **Role-Based Access Control** (REQ-26) – Access control must be enforced at the functional and data level based on user roles.
4. **External Integration Requirements** (REQ-17, REQ-18) – The platform must integrate with external payment providers and notification services, constraining the integration architecture and data exchange patterns.
5. **Data Centralization** (REQ-19, REQ-20, REQ-21) – All user, venue, and activity data must be centralized and maintained in a single authoritative source rather than in disconnected systems.

2.3.3 Open Risks and Points

1. **Booking Conflict Resolution** (REQ-32) – The business policy for conflict resolution (re-accommodation, cancellation, prioritization) when venue availability changes is not yet defined, creating risk of misalignment with stakeholder expectations.
 2. **Tournament Governance and Rules** (REQ-34) – Governance rules for tournaments and competitive events are not specified, creating risk of delayed or incomplete tournament functionality.
 3. **Payment Model Definition** (REQ-33) – Revenue sharing mechanisms and payment models are not specified, creating risk of misalignment between platform capabilities and business financial goals.
 4. **Operational Support Model** (REQ-35) – Operational responsibilities for platform support and maintenance, including SLAs and governance, are not assigned.
 5. **Availability Synchronization Handling** (REQ-36) – When venue availability changes post-booking, the specific business policies and handling logic are not defined.
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2.4 List of References

This Solution Outline depends on and must remain consistent with the following artifacts:

2.4.1 Authoritative Sources

- **Requirements Inventory:** BRD-REQ-INVENTORY v1.0 (36 requirements, derived from Business Requirements Document)
- **Objectives Document:** SO-OBJECTIVES v1.0 (derived from validated Requirements Inventory)
- **C4 System Context Diagram:** docs/03_diagrams/c4_context.puml (C4 Level 1 – System Context)
- **C4 Container Diagram:** docs/03_diagrams/c4_container.puml (C4 Level 2 – Logical Containers)

2.4.2 Cross-References

- **Business Requirements Document** (BRD-SPORTS-PLATFORM v1.0) – Foundation for all requirements and objectives
 - **Architecture Diagrams** – Solution structure and component relationships
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2.5 Solution Architecture

2.5.1 Solution Overview

The Sports Booking Platform is a unified digital system that acts as the central hub for sports activity coordination, replacing fragmented informal communication channels with a coordinated, data-driven platform. The platform serves four primary user roles (Players, Coaches, Venue Operators, Platform Administrators) through web and mobile digital channels, with integration to external payment and notification services.

The solution follows a logical three-tier container architecture as defined in the C4 Container Diagram (docs/03_diagrams/c4_container.puml):

User Channels Layer: - Web App – Provides platform access for players, coaches, and venue operators - Mobile App – Provides platform access for players, coaches, and venue operators - Admin Console – Provides platform administration and oversight capabilities

API and Business Logic Layer: - Platform Backend – Exposes platform capabilities, enforces access control and business rules, and coordinates with domain services

Core Domain Services Layer: - Booking & Scheduling Service – Manages activity bookings, scheduling, and conflict resolution - Venue Management Service – Manages venues and availability schedules - Activity Management Service – Manages publication, discovery, and participation tracking

Integration Layer: - Payment Integration Adapter – Handles optional payment processing integration with external payment providers - Notification Integration Adapter – Manages user notifications about bookings, changes, and cancellations

Data Layer: - Platform Data Store – Single centralized logical data store containing all user, venue, activity, and participation data

2.5.2 System Boundary and Relationships

The C4 Context Diagram (docs/03_diagrams/c4_context.puml) illustrates the system boundary and relationships:

- **System of Interest:** Sports Booking Platform
- **Actors:** Player, Coach, Venue Operator, Platform Administrator
- **External Systems:** Payment Provider (optional), Notification Service (required)

All actors interact with the platform through appropriate digital channels for their role. The platform integrates with external services to enable optional payments and to deliver user notifications.

2.5.3 Key Logical Modules and Responsibilities

User Identity & Role Management – Enables registration and profile management for distinct participant roles with role-based access control ensuring appropriate separation of data and functionality. The system supports onboarding workflows that assign users to roles and enforce role-based permissions governing access and visibility.

Venue Management & Availability – Provides centralized management of sports venues with support for storing basic facility information (name, location, facilities description), maintaining availability schedules, and ensuring that venue data is accessible to coaches and administrators. Availability schedules reflect current booking status and operational constraints.

Activity Management & Publication – Enables coaches and tournament organizers to create and publish sports activities (training sessions, matches, tournaments) linked to specific venues and time slots. Supports definition of activity details, capacity constraints, and participation rules for different activity types, including multi-session tournaments with coordinated scheduling.

Activity Discovery & Booking – Provides participants with capability to search, discover, and view available activities with visibility of activity details, current capacity status, and booking status. Enables participants to book activities subject to availability and eligibility constraints.

Participation & Cancellation Management – Manages participant enrollment and participation lifecycle including confirmation workflows, capacity enforcement (enrollment until capacity is reached), and cancellation handling. Supports identification of affected participants and notification of changes.

Historical & Upcoming Activity Visibility – Provides all user roles with visibility into upcoming scheduled activities and historical records of completed activities, participation status, and activity outcomes to support planning and analysis.

2.5.4 High-Level Flows

2.5.4.1 Player Registration and Discovery (REQ-11)

A player visits the platform, registers with appropriate profile information, and creates a personal profile. The player then searches for available training sessions based on preferences or filters and views detailed information about discovered activities including schedules, venues, coaches, and current enrollment status.

2.5.4.2 Coach Activity Publication (REQ-12)

A coach accesses the platform, selects a venue with available time slots, creates a new training session with details (schedule, description, capacity limits, participation rules), and publishes the activity. The activity becomes discoverable to eligible players.

2.5.4.3 Player Enrollment and Capacity Management (REQ-13)

Players discover and enroll in published activities. The system tracks enrollment and enforces capacity limits, preventing overbooking. When an activity reaches capacity, further enrollment is blocked or placed in a waitlist (handling of waitlists is an open question).

2.5.4.4 Venue Availability Updates (REQ-14, REQ-36)

A venue operator updates venue availability (e.g., closing a time slot due to maintenance or emergencies). The system identifies all activities scheduled during the affected time and determines appropriate business outcomes such as notifying coaches, offering re-accommodation options, or canceling affected activities. The specific business policy for conflict resolution is an open question requiring stakeholder definition.

2.5.4.5 Tournament Creation and Multi-Session Coordination (REQ-15)

A tournament organizer creates a multi-session event with defined participation rules, schedules sessions across multiple time slots and venues, and publishes the tournament. Players can discover and enroll in tournament activities subject to tournament-specific participation rules and eligibility constraints.

2.6 Data Architecture

2.6.1 Data Domains

The platform maintains four interrelated data domains:

User Domain – Centralized storage of player, coach, venue operator, and administrator profiles with role assignments, contact information, and permissions. Ensures users can be authenticated and authorized according to their role.

Venue Domain – Centralized storage of venue information (location, facilities, contact details) and availability schedules reflecting current booking status and operational constraints. Linked to activity scheduling and used by coaches for activity creation.

Activity Domain – Consolidated view of activities (training sessions, matches, tournaments) including schedules, venues, capacity, participation rules, and current enrollment status. Supports discovery, booking, and participation management.

Participation Domain – Records of participant enrollment, confirmation status, cancellation status, and historical participation records for audit and analysis. Enables visibility into participation history and supports conflict handling.

2.6.2 Data Consistency and Visibility

The platform must provide near real-time visibility of schedules, availability, and participation status updates across all users. The specific definition of “near real-time” (acceptable latency thresholds in seconds or minutes) requires stakeholder clarification and will be documented in detailed specifications.

2.6.3 Data Retention and Audit

Historical records of activities and participation must be maintained to support audit, compliance verification, and analysis. Data retention and archival policies are not yet defined and require stakeholder input.

2.7 Integration Architecture

2.7.1 External Systems

Payment Provider – Third-party payment processing service enabling optional online payment functionality. Integration is optional and supports transaction processing, payment status tracking, and confirmation notifications.

Notification Service – Third-party service providing user communications about bookings, activity changes, cancellations, and other relevant events via email, SMS, push notifications, or other channels. Integration is required for user communications.

2.7.2 Integration Responsibilities

The Platform Backend orchestrates integration with external services:

- The Payment Integration Adapter handles communication with the Payment Provider for optional payment processing. The specific payment model (direct payment, escrow, platform fee handling) is an open decision.
- The Notification Integration Adapter handles communication with the Notification Service for sending booking confirmations, activity changes, and cancellation notifications. Specific notification channels (email, SMS, push) and delivery guarantees are open decisions.

2.7.3 Interaction Patterns

User channels (web and mobile) interact with the core Platform Backend for all activity discovery, booking, profile management, and venue management operations. The Platform Backend delegates business logic to domain services and coordinates with external services as needed to fulfill transactions and communicate with users.

2.8 Security Architecture

2.8.1 Authentication and Authorization

The platform must implement role-based access control (RBAC) ensuring that users can only access and modify data appropriate to their role. Authentication mechanisms must verify user identity before granting access.

The platform supports four distinct user roles (Players, Coaches, Venue Operators, Platform Administrators) with role-based permissions governing what capabilities each user can access and what data they can view or modify.

Open Question: Detailed RBAC matrices and permission models for each role have not been defined in the inventory and require stakeholder input.

2.8.2 Data Protection and Privacy

The platform must protect user data according to applicable regulations. Personal information including user profiles, contact details, and participation history must be handled according to data protection principles.

Open Question: Specific applicable regulations depend on deployment geography (GDPR for EU, CCPA for California, etc.) and require clarification during design phases.

2.9 Implementation Teams

The following teams are responsible for translating the Solution Outline into implementation:

Product and Requirements Team – Responsible for validating business requirements, clarifying ambiguous policies (booking conflicts, eligibility rules, cancellation policies), and working with stakeholders to define open business decisions.

Architecture and Design Team – Responsible for translating objectives into detailed logical architecture, designing data models, defining system integrations, and ensuring alignment with constraints (cloud deployment, independent scaling, compliance).

Development and Engineering Team – Responsible for implementing the platform across all functional capabilities, integrating external services, and ensuring technical compliance with non-functional requirements.

Operations and Support Team – Responsible for defining operational procedures, support models, maintenance workflows, and governance for the platform (implied by requirements but not yet detailed).

2.10 Non-Functional Requirements

2.10.1 Responsiveness and Near Real-Time Visibility

The platform must provide near real-time visibility of schedules, availability, and participation status updates across all users. The specific definition of “near real-time” (acceptable latency thresholds in seconds or minutes) requires stakeholder clarification and will be documented in detailed specifications.

2.10.2 Scalability

The platform must support independent scaling of different functional areas to accommodate growth in users, activities, and data volume over time. This enables the platform to evolve with additional sports and advanced features without architectural redesign.

2.10.3 Reliability and Availability

The platform must operate reliably as a central hub for sports activity coordination. The criticality of the platform as a single point of coordination implies high reliability expectations. While specific availability targets and SLAs are not defined, the platform’s role in enabling coordination across all stakeholders makes reliability a critical quality attribute.

2.10.4 Data Protection and Compliance

The platform must comply with applicable data protection and privacy regulations. Specific regulations (GDPR, CCPA, etc.) depend on deployment geography and require clarification during design and planning phases.