National Ambitions for Sports Venues

by

Mohammed N Mazher

Chief Business Officer |ACES

20th Nov, 2024

Saudi Arabia plans for new Stadiums

Saudi Arabia is set to make a significant impact on the global sports stage with its bid to host the 2034 FIFA World Cup. The bid includes plans for 11 new stadiums, highlighting the country's commitment to modernizing its infrastructure and enhancing its international profile. The announcement, made in Paris, showcases the kingdom's intent to build new stadiums across five key cities: Riyadh, Jeddah, Khobar, Abha, and Neom's futuristic city, The Line.

FIFA WORLD CUP 2034 :

Football is the world's most loved and most watched sport
3.5 billion fans worldwide and up to 250 million players across the globe
Saudi Arabia is focusing on the bid to host the FIFA World Cup 2034

Football, or as it is endearingly known "the beautiful game", is changing. Its balance of power which resides in European leagues such as the UK's English Premier League and Spain's LaLiga is being challenged by an unexpected newcomer, the Kingdom of Saudi Arabia. The impact of the change is being felt globally by players, clubs, and fans alike.

FIFA Requirements for Communications technologies

Voice communications technologies include:

- PMR;
- matrixed wired and wireless intercoms systems;
- fixed-line telephony services; and
- **the latest generation of mobile telephony services.**

The Stadium Authority is responsible for making the existing Stadium infrastructure, support and operations agreements available to FIFA for use during the Competition. This would include e.g., voice-over internet protocol (IP) systems, distributed antenna systems designed to meet high-density and high-capacity requirements, trunked radio base stations (e.g., Trunked Terrestrial Radio (TETRA), digital mobile radio (DMR) or other technology) and intercom panels, plus any cabling or other passive infrastructure in place. It is the responsibility of the Stadium Authority to ensure that there is full coverage throughout the Stadium precinct and within internal spaces, and that all parts of these systems are tested and certified to be in good working order.

City-wide mobile/cellular infrastructure

High-quality, ubiquitous mobile network services are critical for all stakeholders at the Competition, providing voice and data connectivity supporting both the successful delivery and operation of the Competition and also the enjoyment of spectators and other visitors within the Venues.
Mobile network services encompass the mobile network coverage and capacity to be provided by MNOs, who shall collectively provide mobile network coverage and capacity throughout the Host City.

- All MNOs in the Host City shall provide latest generation (e.g., 5G, 6G or other future technological advances) mobile network coverage and capacity to all official Sites.
- The mobile network coverage and capacity provided shall utilize internationally recognized, standards-based, commercially available mobile networks to provide voice and data connectivity for end users to international telecommunications networks and to the public internet.
-

The mobile network service provided by each MNO shall satisfy the service availability requirement greater than 99.8%.

EVENT TECHNOLOGY REQUIREMENTS

- Telecommunications and network infrastructure
- Community access television service (CATV)
- Press conference audio and video systems
- Private mobile radio (PMR) service
- Mobile network service

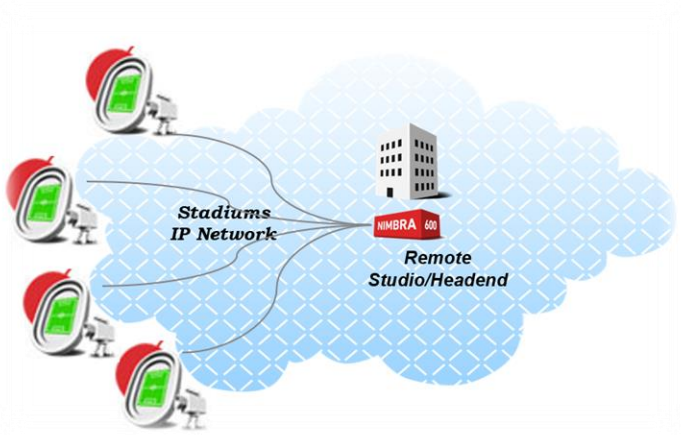
The Stadium Authority is responsible for the delivery of the above event technology project scope in line with FIFA technology standards. This includes equipment, implementation services, logistics, power and facilities, plus operations and maintenance of these technology solutions by suitably qualified and experienced technicians and support staff, either incumbent or contracted service providers. Specific details, such as system designs and configurations, bandwidth requirements, equipment and operating locations, etc., shall be defined by FIFA and provided iteratively to the Stadium Authority via a series of Technology Requirements documents.

Smart Stadium Solution

Smart Solution

Fan Experience

- Smart Parking
- Food And Drinks Ordering
- Indoor Navigation
- Video Streaming (Remote Production)
- Replays



Stadium Operations

- Security Cameras With Facial Recognition
- Real Time Efficient Crowd & Access Control
- Automated Emergency Response
- Sustainability Solutions - Improving Energy Efficiency

ACES Smart Stadium Vision

- Experience
- Safety and Security
- Operational Efficiency
- Reduced costs
- Communications
- Facilities usage
- Sustainability
- Scalability
- Marketing Opportunities
- Retail Solutions

Visualizations and Analytics

Knowledge building Services

Big Data | Data Lake | Query Engine | Serving Databases | AI/Machine Learning | 4.5 Application Specific Services | Application Development Tools/Services | Productization

IoT and Enterprise Service Layer

Device Management | API Manager | Application Integration | Rules Engine | Timeseries DB

Device Integration | Event Hub | Notification Engine | Platform Query Engine

Smart Stadium Subsystems

Energy	Traffic	Lighting	Smart Waste	Robotics
Parking	Irrigation	Digital Wayfinding	Noise Management	Autonomous vehicles
Air Quality Monitoring	Building Management	Traffic Management	Crowd monitoring	Drones

Security Subsystems

PSIM

Edge Devices and Sensors

ANPR Cameras	Digital Signage	Digital Kiosks	Ticket Machines	Speakers
Water Level Sensors	Water Quality Sensors	Lighting Controllers	Lighting Sensors	Fire sensors
Energy Meters	Soil Moisture Sensor	Smart Timer/ Controller	Flow Meter	Smart Poles
Payment Kiosks	BLE Beacons	CCTV Cameras	Parking sensors	Smart Manholes

Internal and External Systems

CAFM | Weather | GIS | SIEM

CMS | CRM | ERP | IAM

Payment Gateway | Voice Processing Services | Media Services

Government E-Services | AR / VR Services | External Agencies

Converged Infrastructure

GSM(4G/5G)

IoT

Wi-Fi

Cloud

Edge

Fiber

Security

Data Management

Quality

Governance

Smart Stadium Architectural Overview

ACES Implemented
Neutral Host - Stadiums

King Saud Stadium

King Abdullah Sports City

General Sports Authority
الهيئة العامة للرياضة

Success Story:

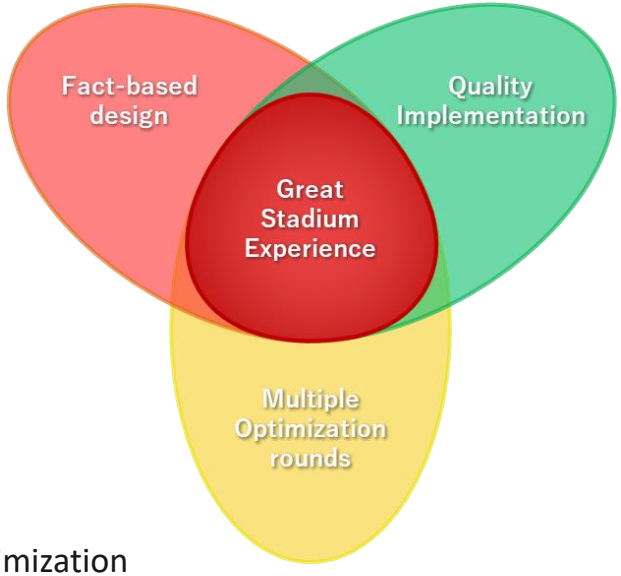
Project Info: Stadium capacity is 25,000 & total area covered is 95,680 m²
NH DAS Information: Sharable Active DAS MIMO system supporting the following bands: 900,1800 and 2100 MHz & 5G 4X4 indoor area & 64x64 for seating area
Location : Riyadh
Start: 2020 **Duration:** 10 Years

SECTORS	ANTENNAS
4G 19 5G 29	4G 132 5G 66
MIMO	**REMOTE UNITS**
Massive 64X64	4G 68 5G 26

AlAwwal Park (KSU Stadium):

Stadium Design and Optimization:

Design: IBS design process at stadium take very long time and to be been reviewed and approved by stadium approved consultant.



Implementation: the Quality of IBS installation at stadium play a major rule on sites performance due to the important of PIM values at high-capacity venues.

Optimization: at stadium environment, multiple optimization rounds during high density events will be required to reach to optimize sites performance.

Design/Optimization Challenges:

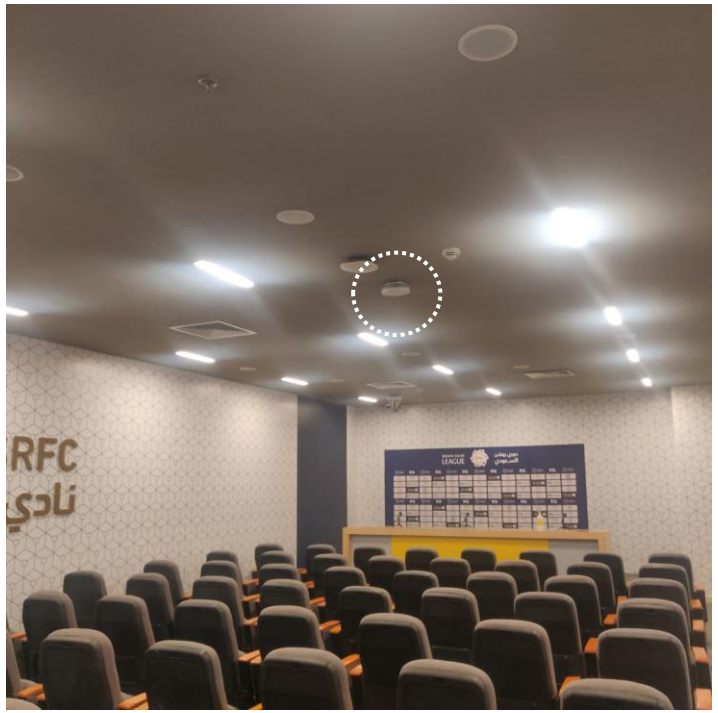
- Stadium Structure Challenges.
- High-Capacity Venue.
- High DL and UL throughput demand.
- Power and Space Limitation.
- Inferences Management Between High Number of Sectors.
- Future Proof / Scalability.
- Outdoor Sites Interference.

Deployment Challenges:

- Aesthetic Requirements.
- Antennas Placement.
- Cable Routing Challenges.
- RF Power Tunning.
- Power Sources Availability.

Sample of Installation at Al Awwal Park:

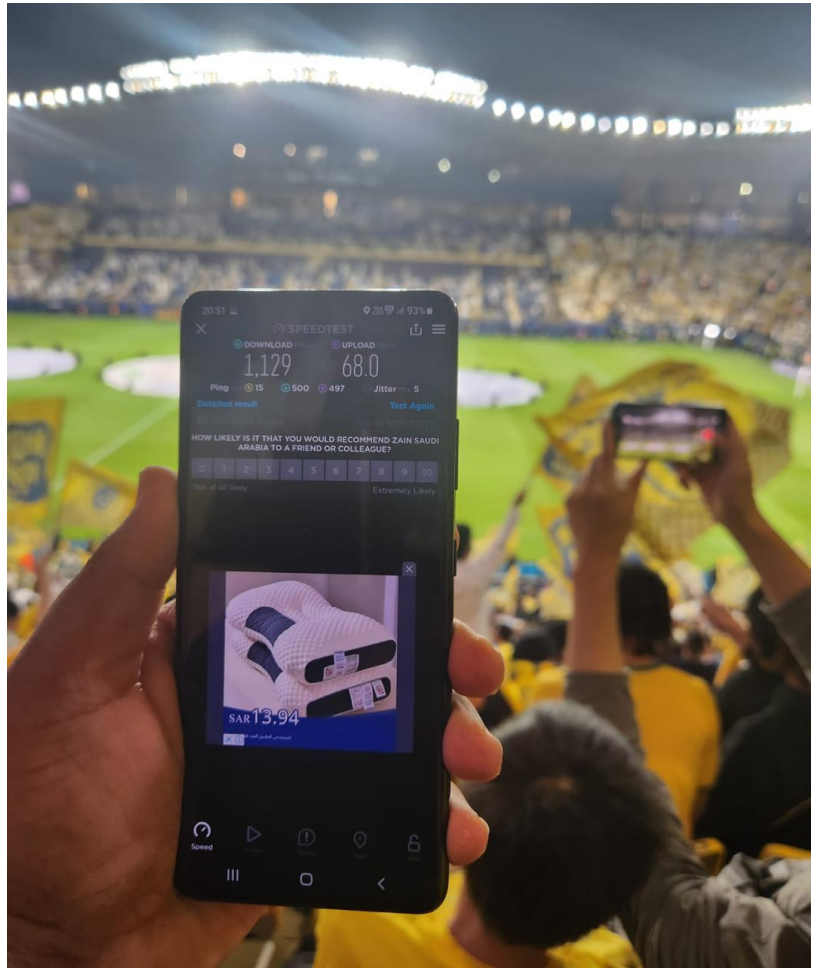
Outdoor 5G Radio

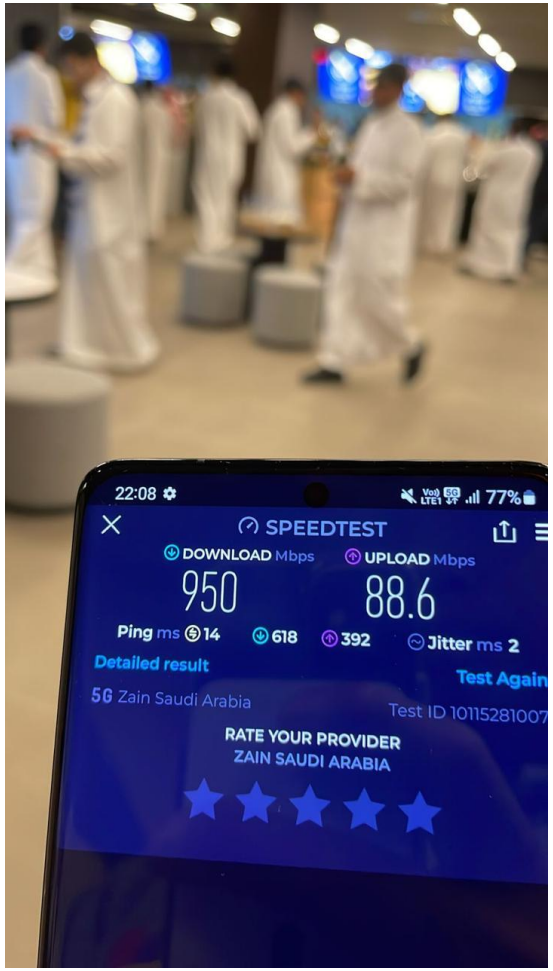


Indoor 5G small cell

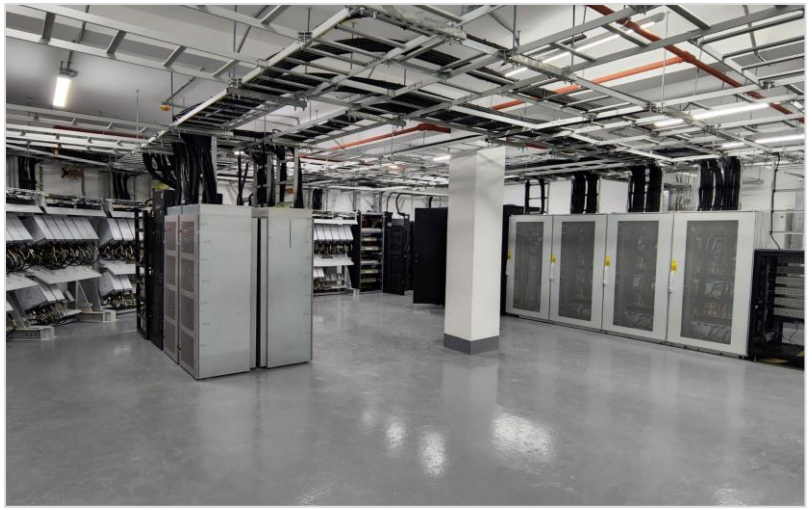
Wi-Fi AP under the seats

Rich Mobile User Experience
Sample of 5G Throughput Test:

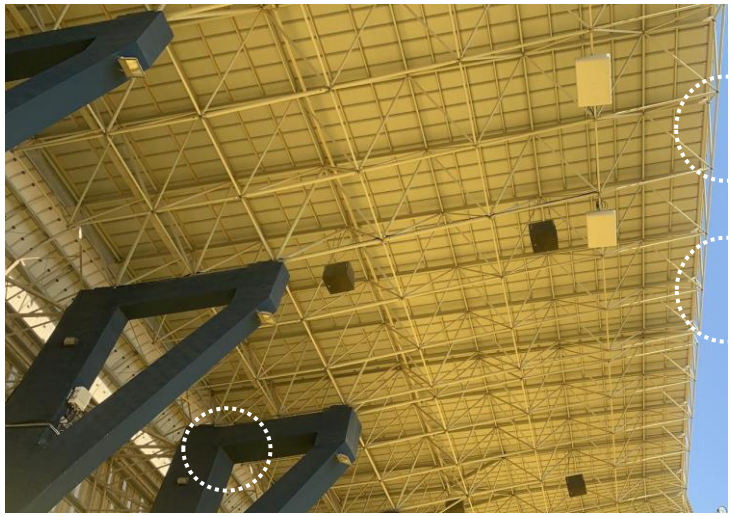




Sample of Installation at Al Awwal Park:



Main Equipment room

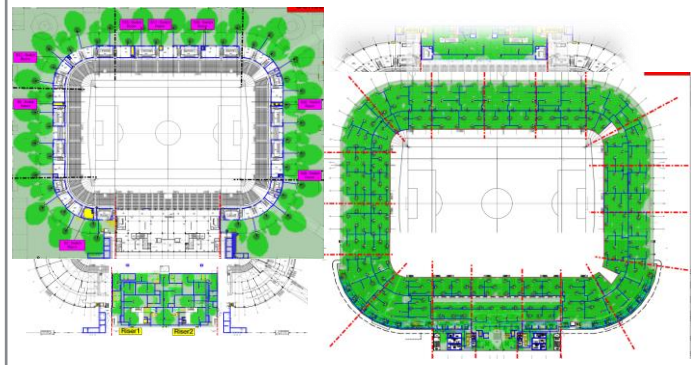


Stadium Antenna on CATWALK

RU at Low Current Rooms

Wi-Fi Solutions at Al Awwal Park

Design:



Monetization:

Step: 1.

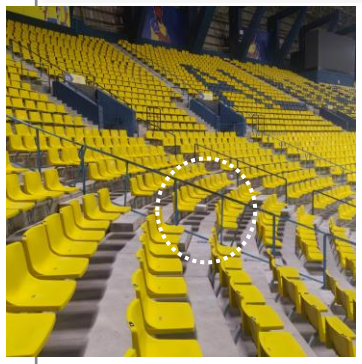
Data Collection Via Guest Wi-Fi

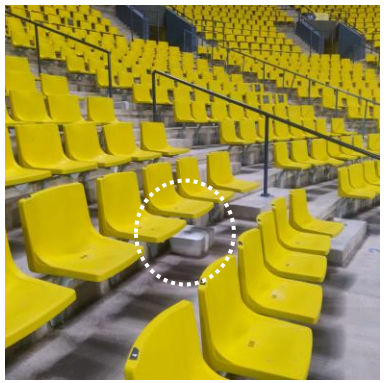
Encourage fans to connect to Wi-Fi and enroll to CRM for future engagement.

Step: 2.

- **3rd Party Ads:** Agreement with Sports and F&B brands to promote their brand.
- **Stadium Ads:** Promote outlets, upcoming events, loyalty program, etc.

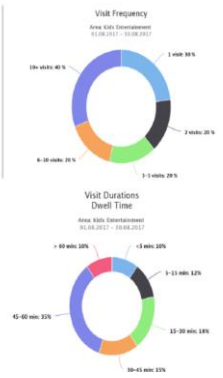
Implementation:



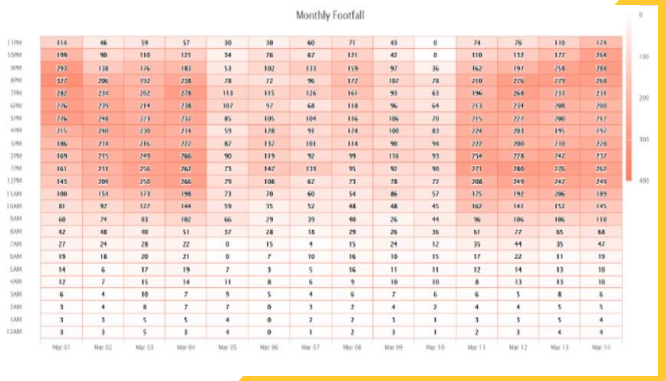


Analytics:

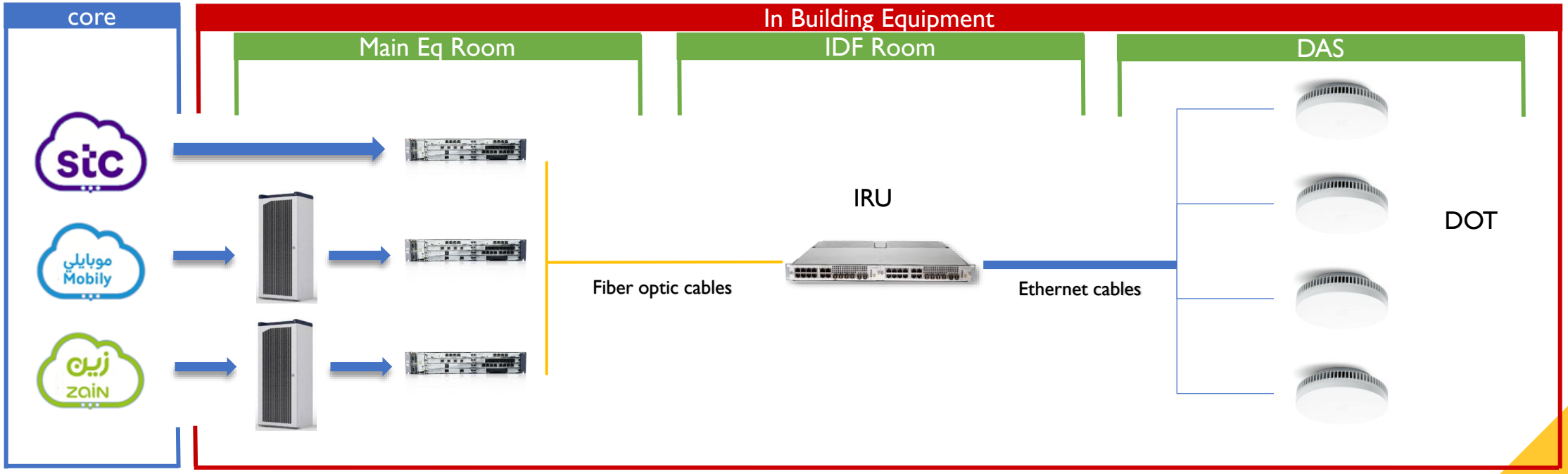
Trends



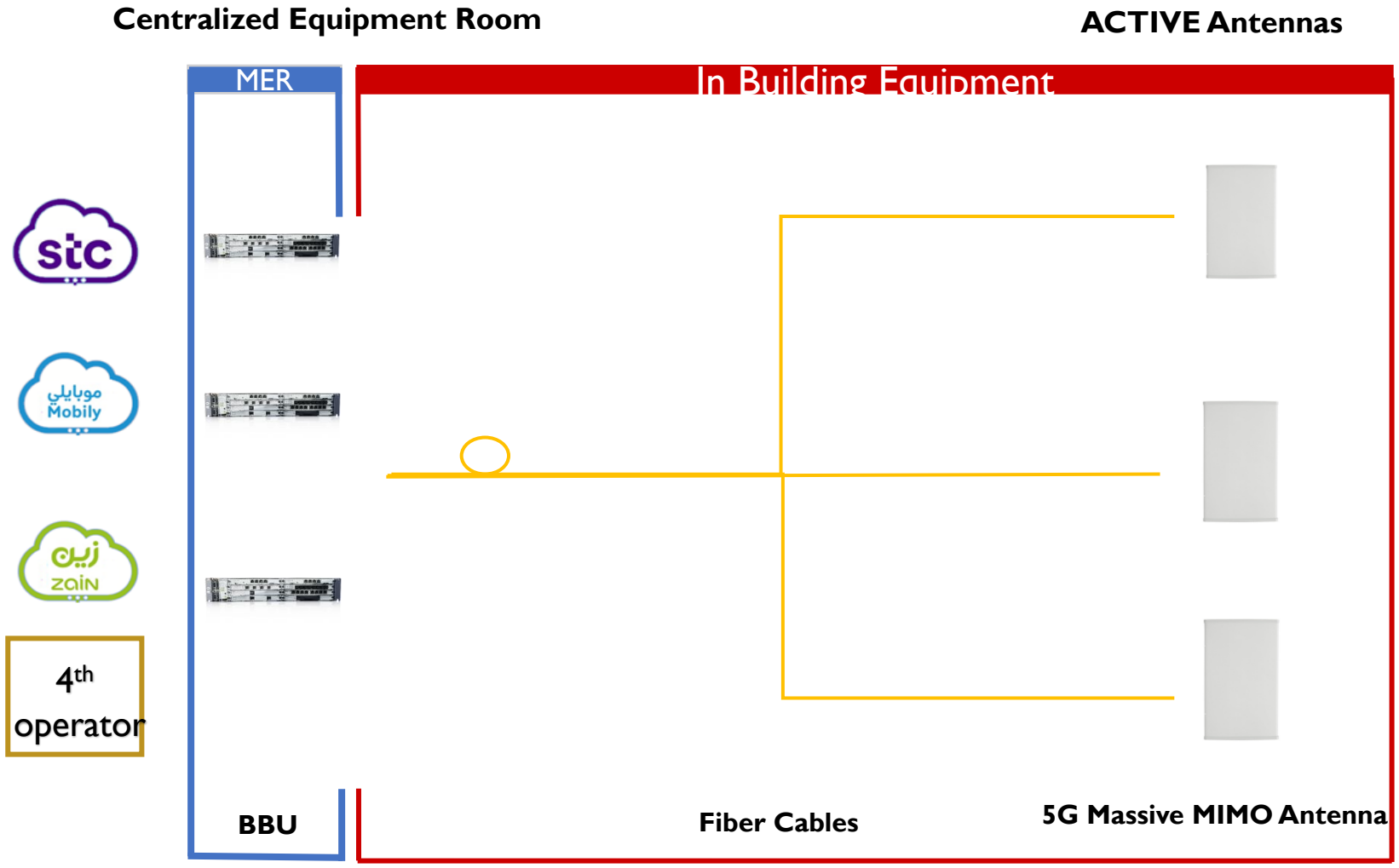
Heatmap & Footfall



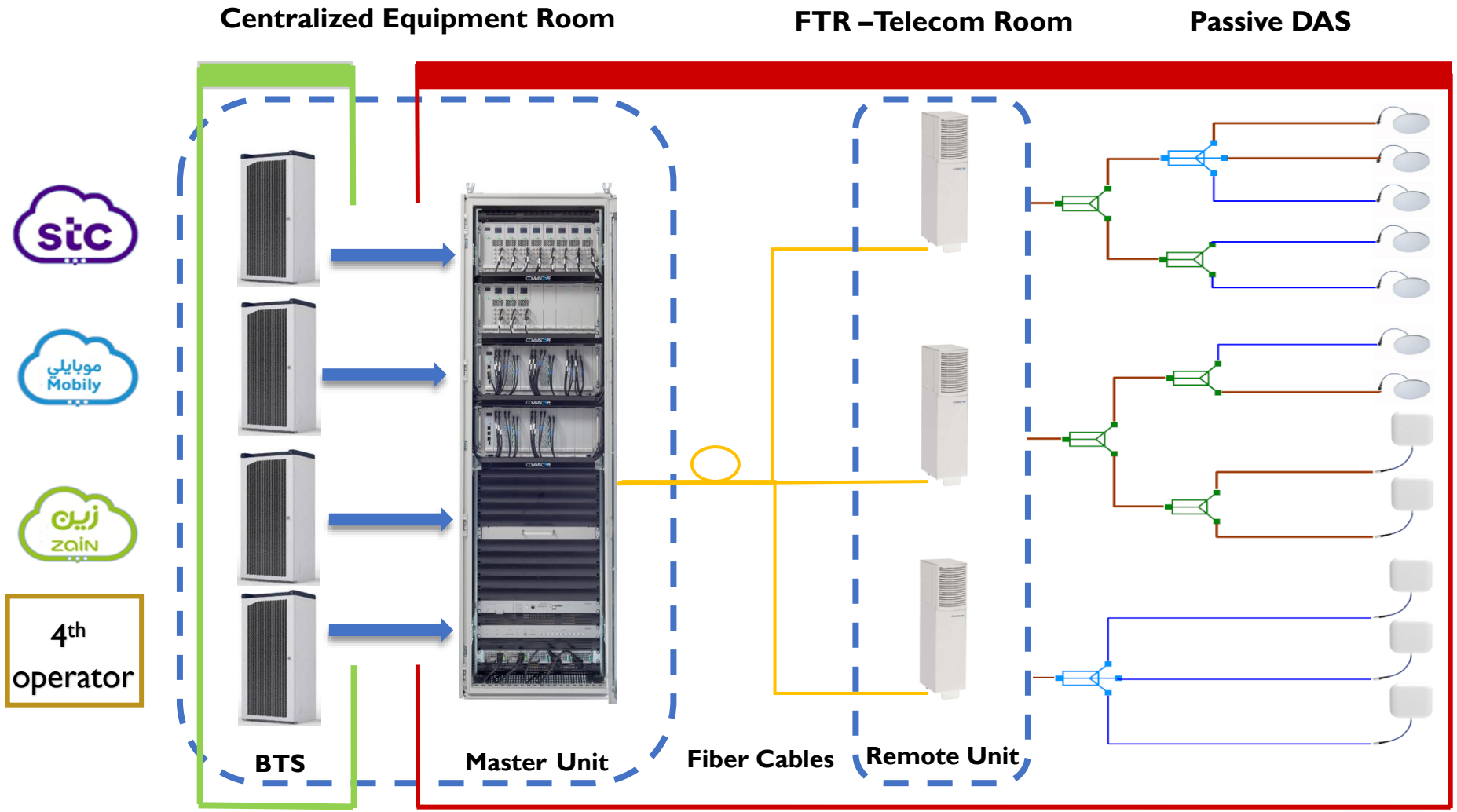
Sample System Schematic Diagram (5G)Indoor Area



Sample System Schematic Diagram (5G)

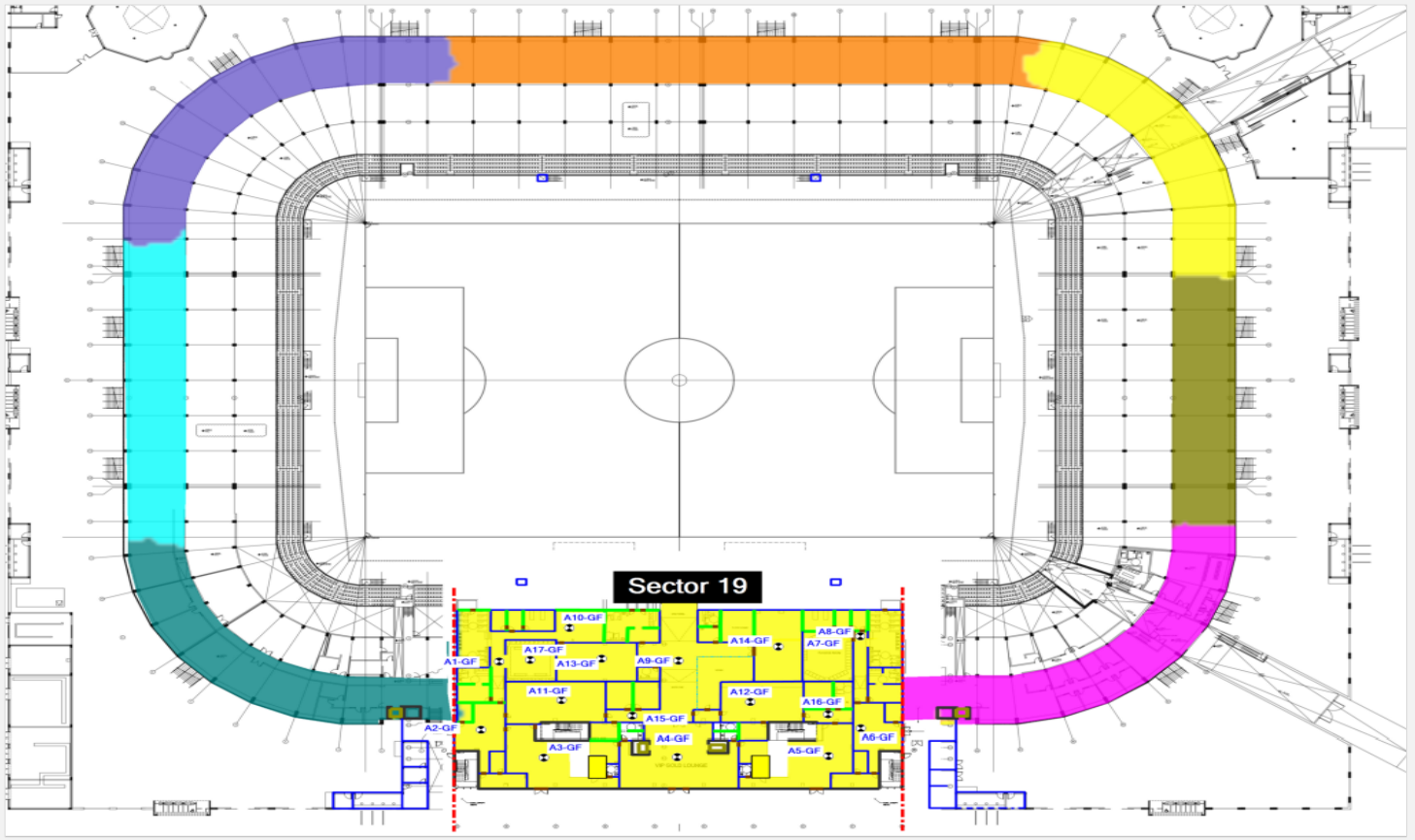


Sample System Schematic Diagram (4G)

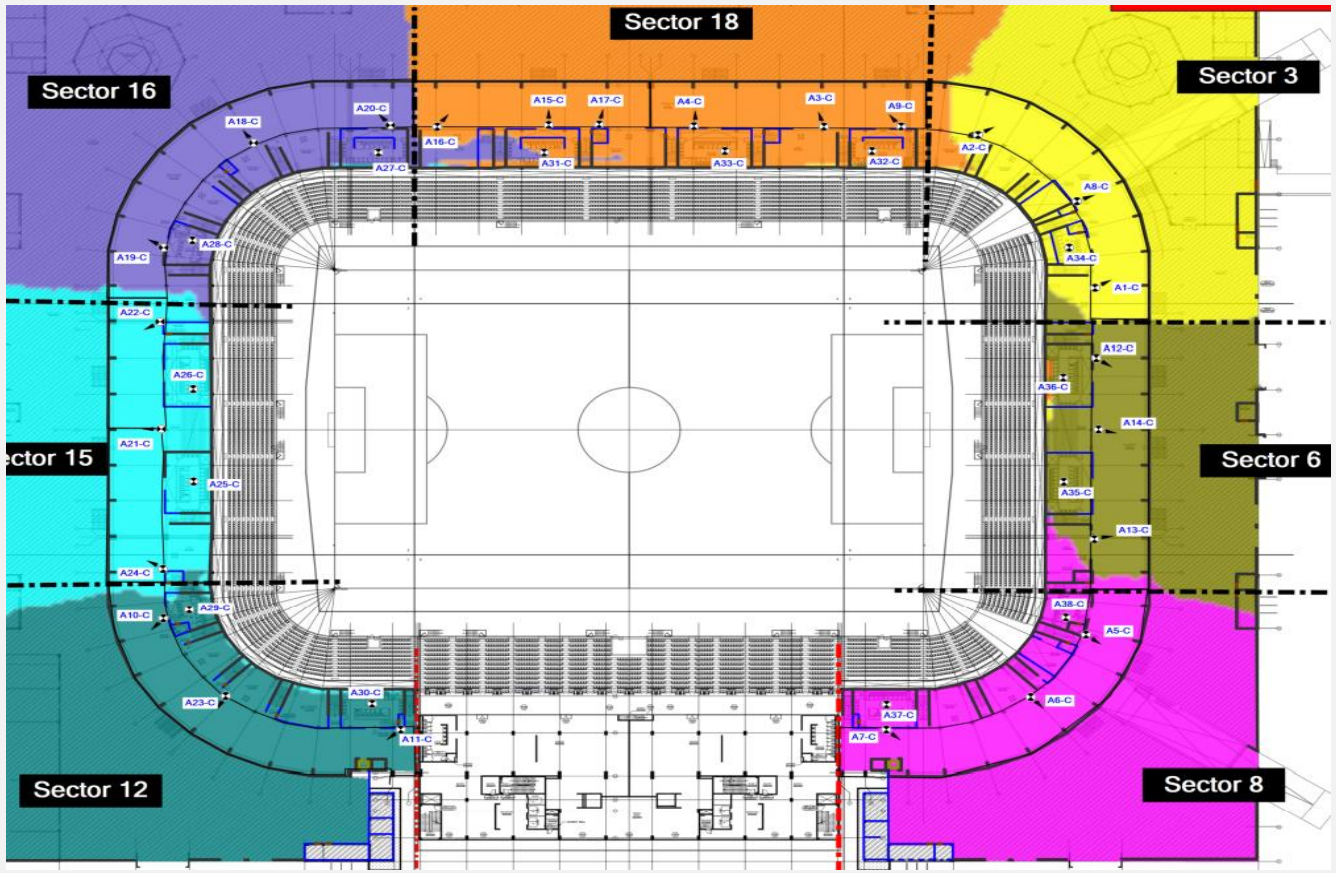


Sectorization (2G/4G/5G)

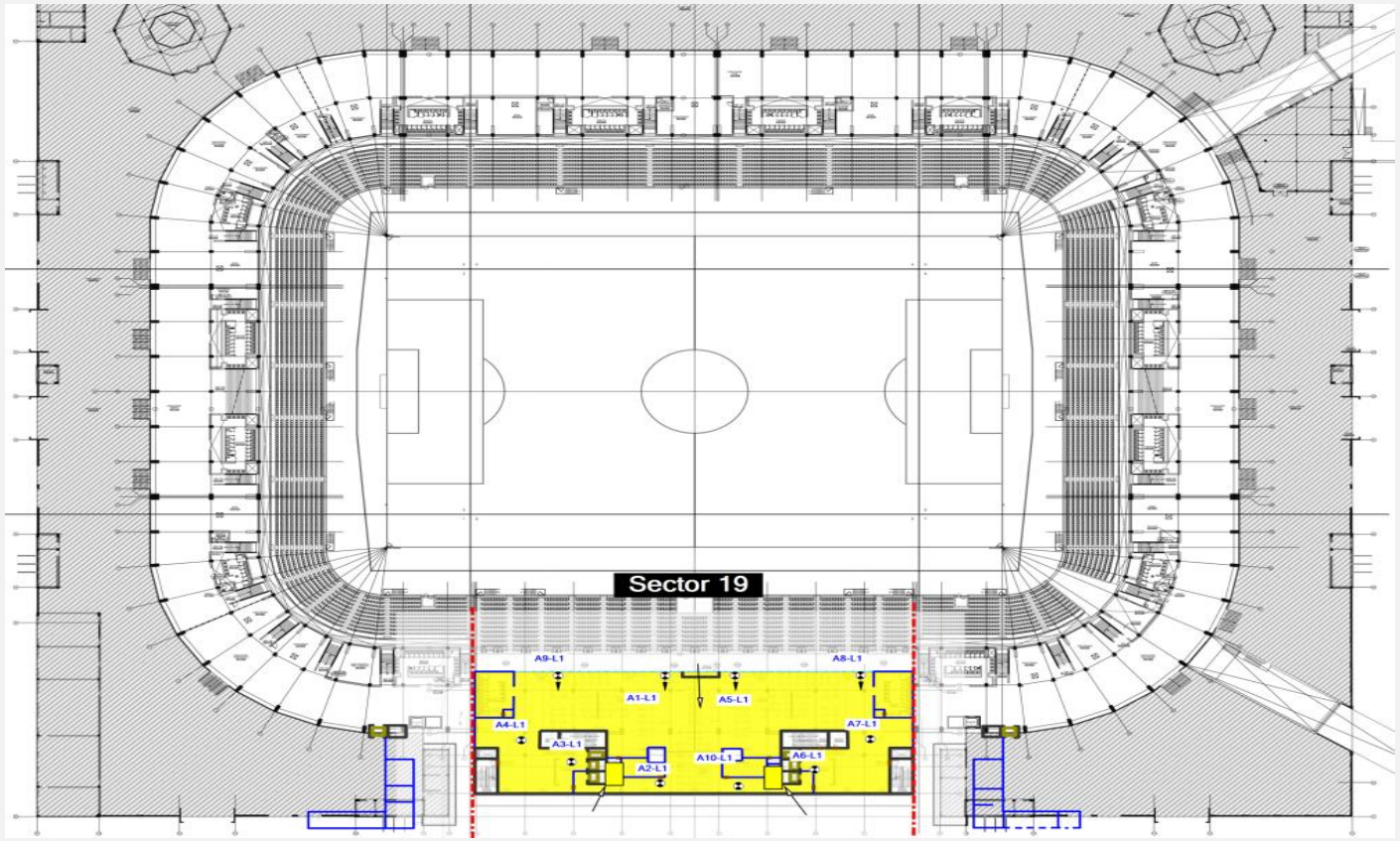
Ground Floor	Concourse	Level 1	Level 2	Level 3

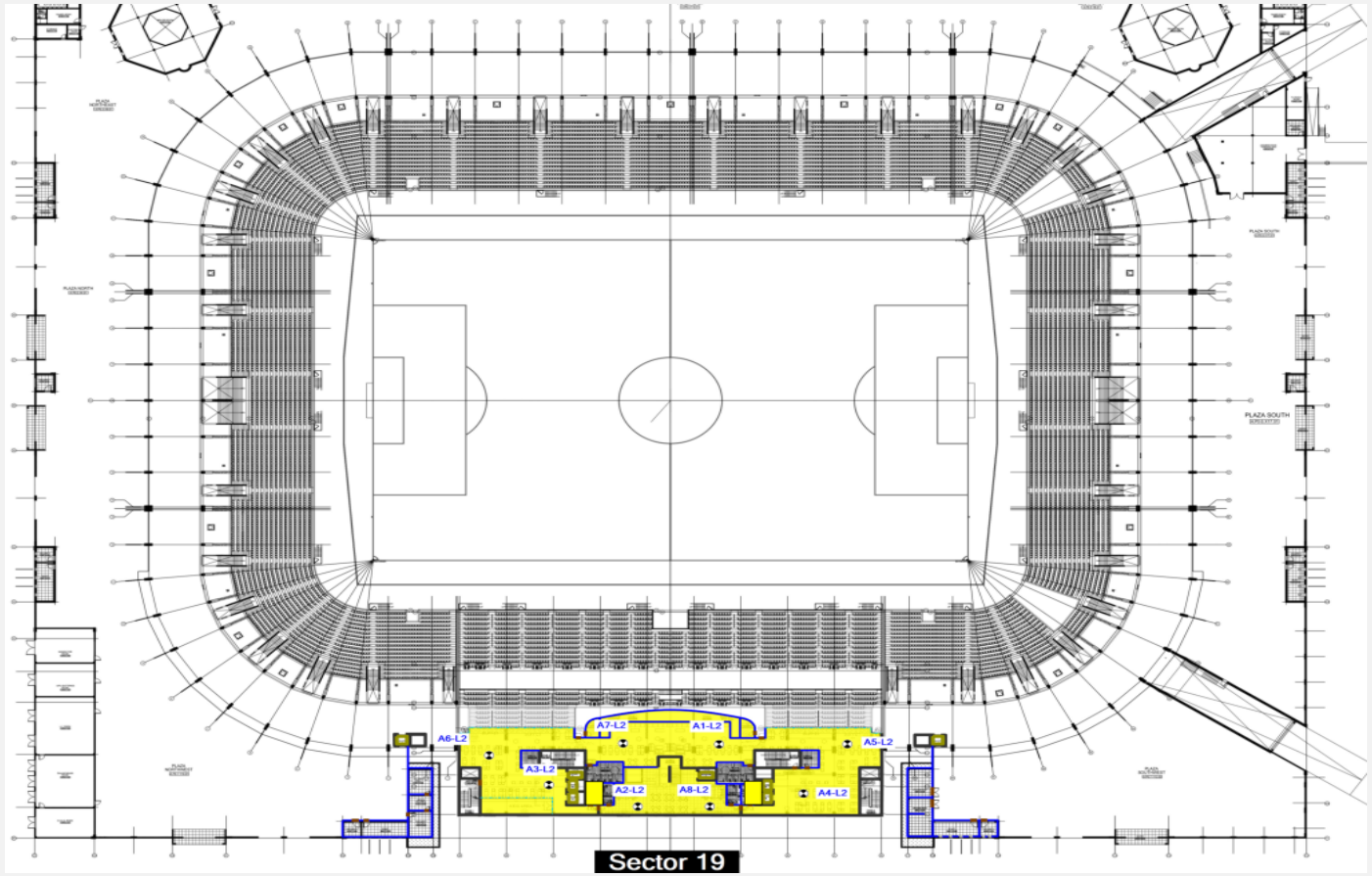


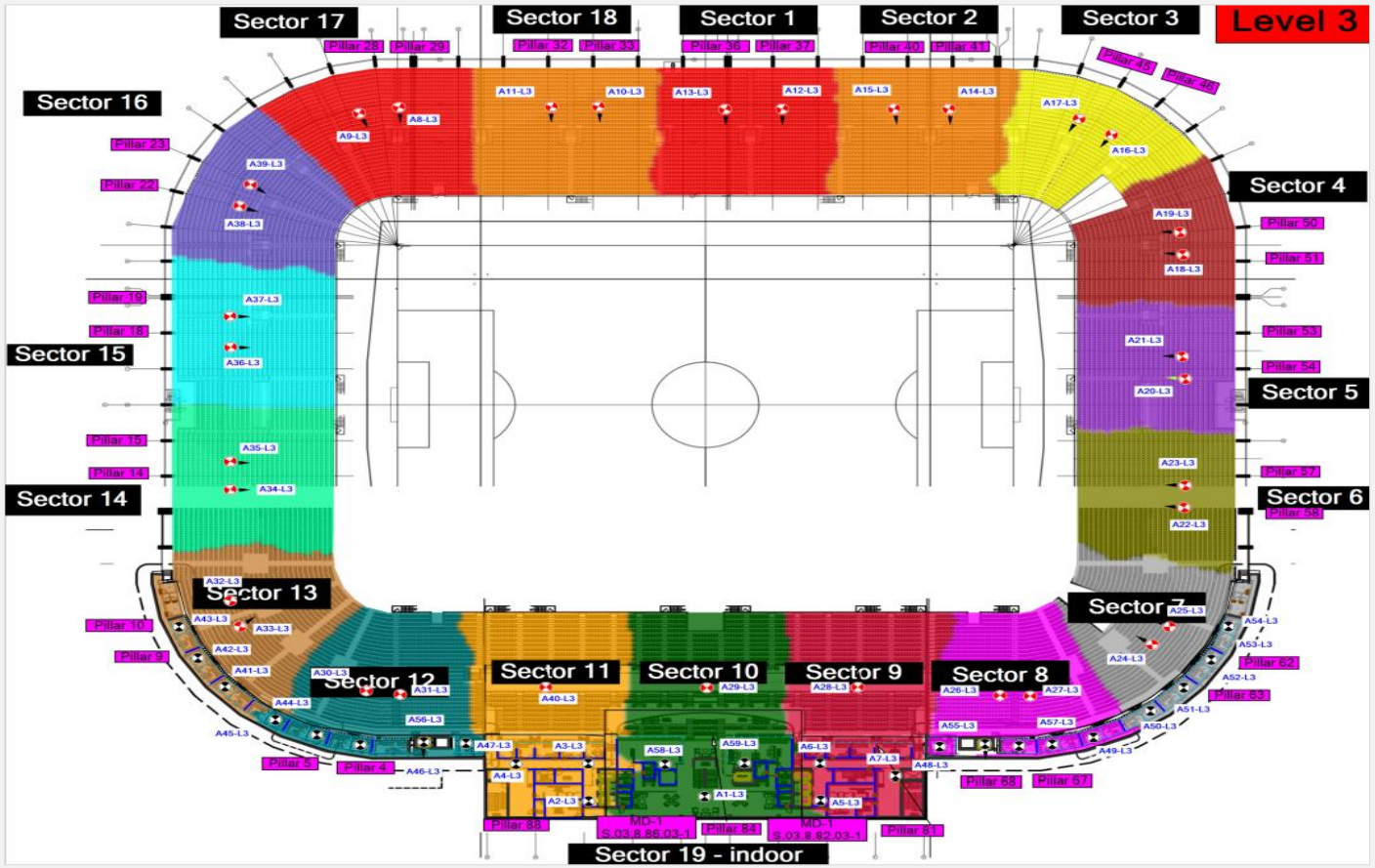
Ground Floor | **Concourse** | Level 1 | Level 2 | Level 3

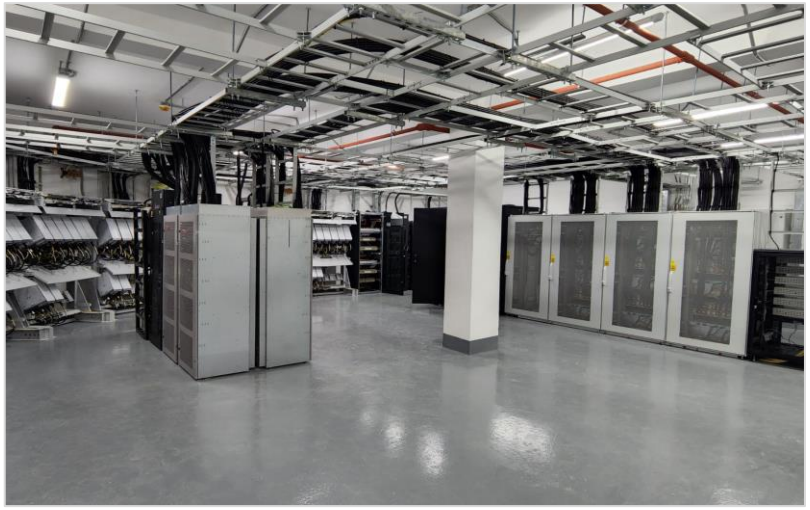


Ground Floor | Concourse | **Level 1** | Level 2 | Level 3




A7-L2
A1-L2
A6-L2
A5-L2
A3-L2
A2-L2
A8-L2
A4-L2
PLAZA SOUTH
Sector 19

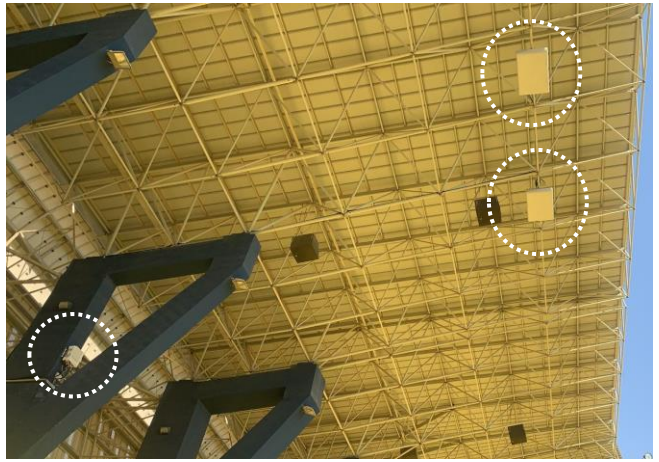

Level 3
Sector 17
Sector 18
Sector 1
Sector 2
Sector 3
Sector 4
Sector 5
Sector 6
Sector 7
Sector 8
Sector 9
Sector 10
Sector 11
Sector 12
Sector 13
Sector 14
Sector 15
Sector 16
Sector 19 - indoor

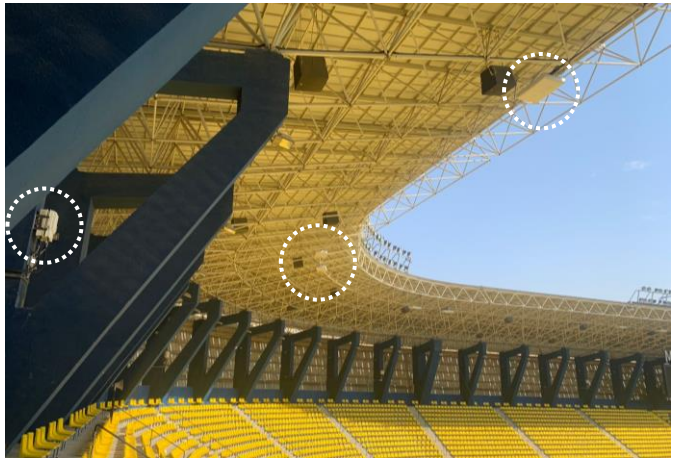


Main Equipment room

Outdoor 5G AIR Radio

Indoor 5G DOT



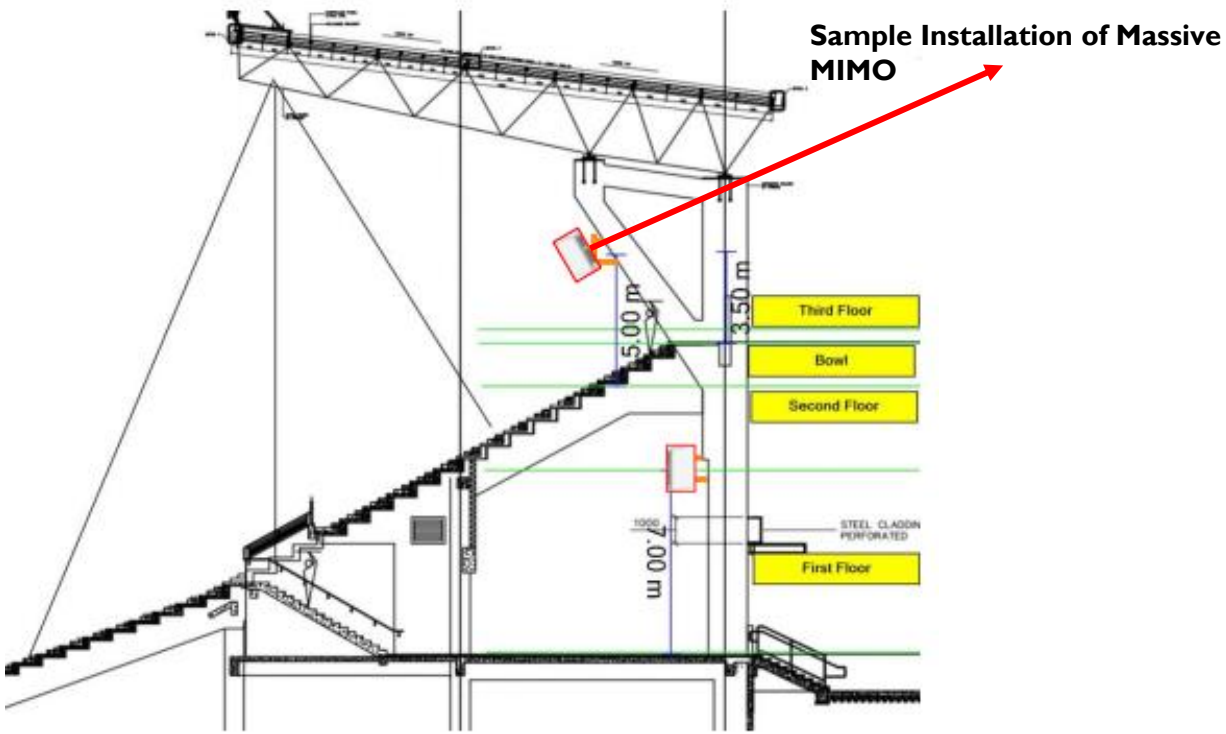


Stadium Antenna on CATWALK

RU at Low Current Rooms

5G System Architecture for seating areas

32x32 /64x64 MIMO 5G system will be proposed for Seating areas and Piazza inside Stadium facilities .



AIR 6449 B43

KRD901203/11

AIR 6449, a TDD Antenna Integrated Radio unit with 64 transmitters and 64 receivers, improves LTE TDD spectral efficiency. It has enhanced Common Public Radio Interfaces (eCPRI) and its operational bandwidth is 200 MHz. AIR 6449 is part of the Ericsson Radio System portfolio.

AQQL AirScale MAA 64T64R 192AE n78 320W - eCPRI

Wide band massive MIMO Adaptive Antenna Solution for n78 (3.4-3.8 GHz)

Product Benefits

- Adaptive Antenna System for optimized capacity and coverage
- Digital beamforming for multi-user MIMO
- Beamforming capable 64T64R with total 320 W output power
- Wide frequency range with 200 MHz occupied BW

Specification*	Details (Preliminary)
RAT standards	NR, ready for LTE
TX/RX, BF, AEs	64T64R, Digital Beamforming, 192AE
Max Output Power	320 W
Supported Bands	n78 TRX: 3400-3800 MHz
Instantaneous bandwidth (IBW)	400 MHz
Occupied bandwidth (OBW)	200 MHz
NR Carrier bandwidth	Up to 100 MHz, 2 CC combinations
Fronthaul Support	eCPRI
Supply voltage	-48 V DC
Operational temperature range	-40 °C to +55 °C / Active Cooling
Dimensions (H x W x D)	1001 x 448 x 113 mm
Volume / Weight	49 l / 36 kg
Power Consumption	Max. 1720W

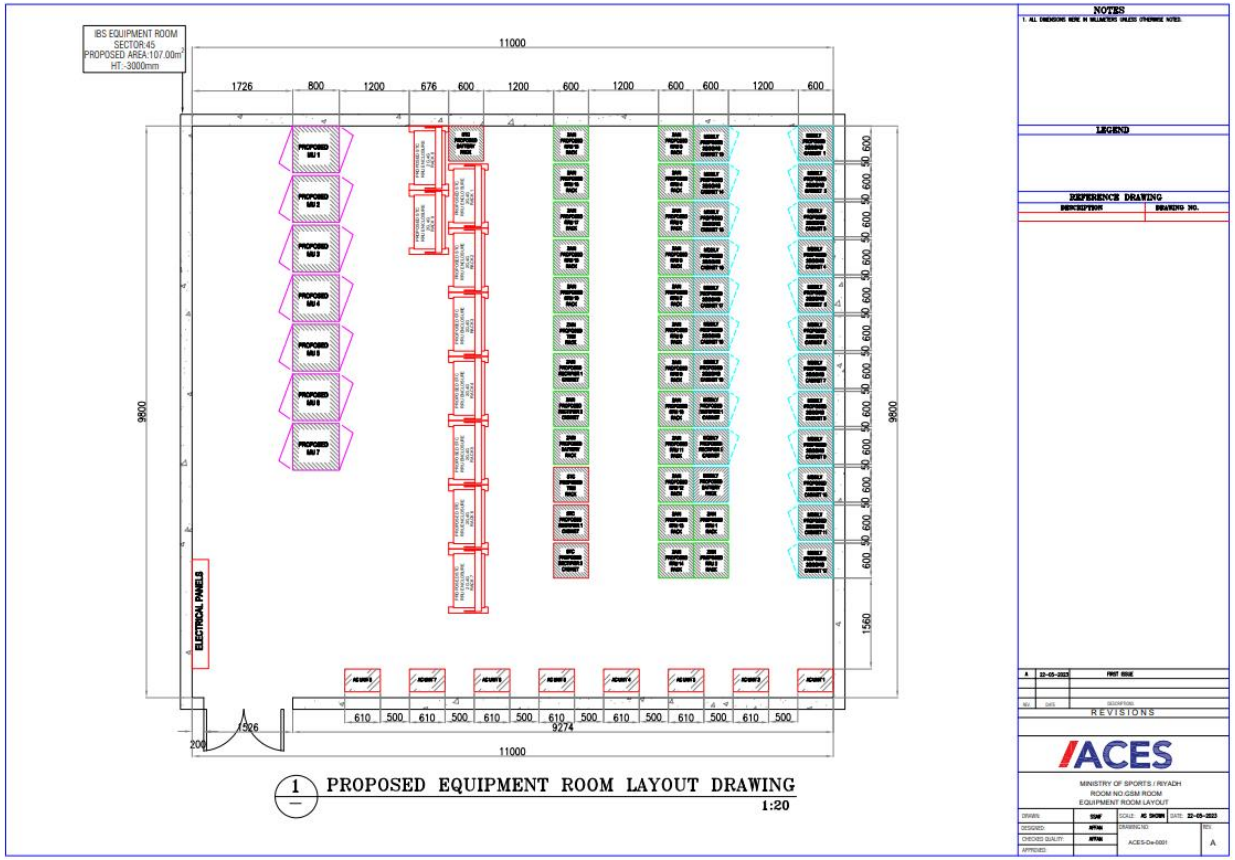
45,000 Seats Capacity

Area:
110 Sq. m

Power:
1250 Amps,3P,380VAC

Cooling :
67.0 Tons

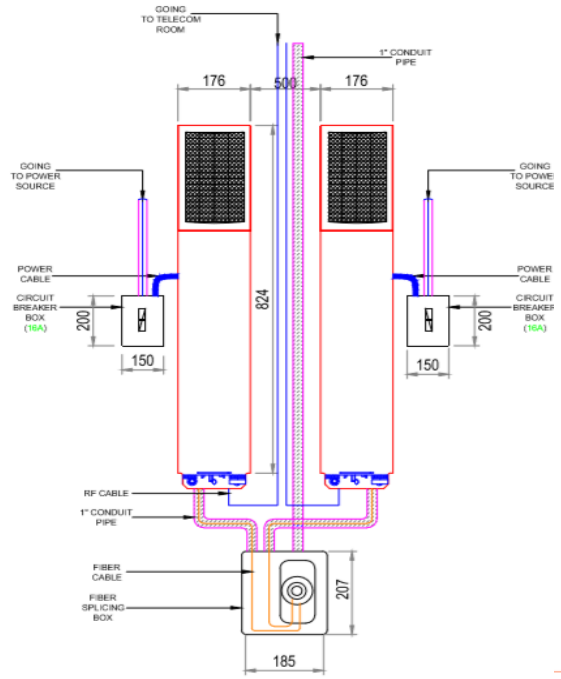
FM200 :
178.0 KG



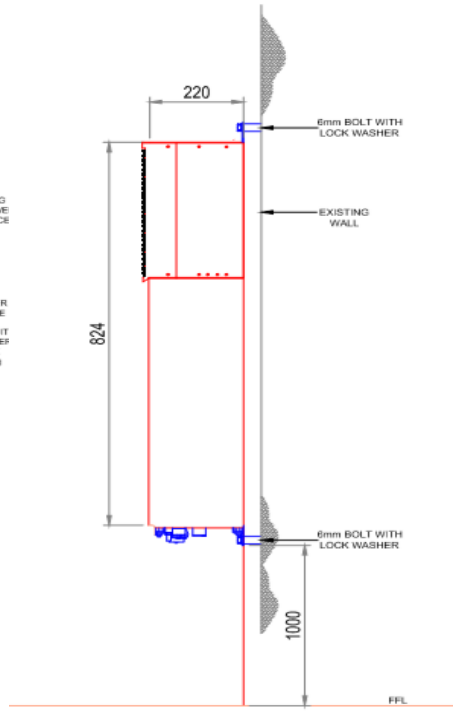
1 PROPOSED EQUIPMENT ROOM LAYOUT DRAWING
1:20

Area:
At any non-public location, but preferably in LOW current rooms.

Power:
16 Amps,1P,220VAC for each RU



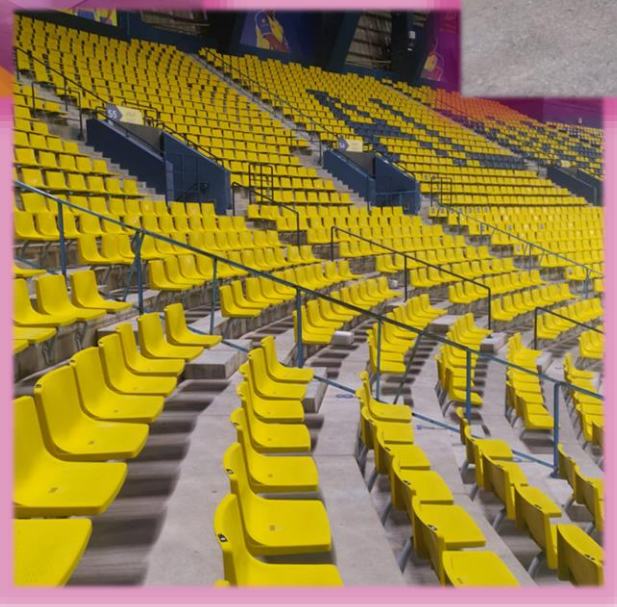
2 REMOTE UNIT ELEVATION INSTALLATION (WALL MOUNTED)



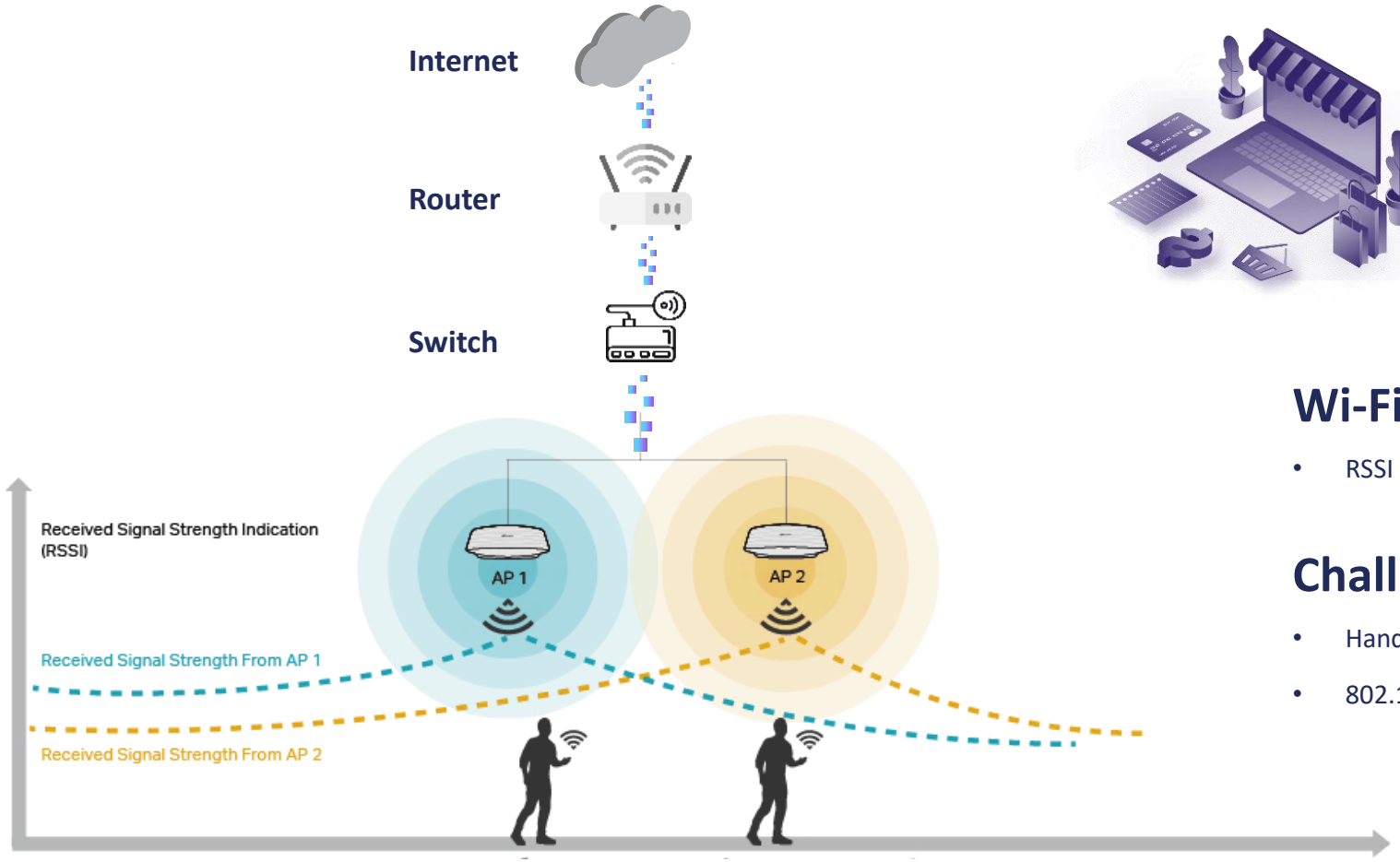
REMOTE UNIT INSTALLATION SIDE DETAILS

The required quantity of the above RUs in the LOW current room will be determined by the quantity and distribution of stadium's LOW current rooms.

4



Mobility in Wi-Fi Networks



In a multi-vendor deployment, there are still many issues to be handled by system integrators/developers.

Wi-Fi Handover:

- RSSI Monitoring, AP Scanning, AP Switching

Challenges:

- Handover speed, interruption, authentication
- 802.11 k,r,v addressed many issues

Wi-Fi Provisioning System

ACES Research & Development Team developed an in-house system that:

- Enables full customization of the Wi-Fi provisioning process
- Provides a content management system (CMS) for easy management and update of the Wi-Fi process pages
- Can be fully customized to accommodate additional requirements and regulations, e.g., phone number verification, etc.

Wi-Fi provisioning typical process is

- Typically governed by a set of regulations (government, venue owners, etc.)
- Often have dynamic requirements (e.g., consents, announcements, dynamic content, etc.)
- Commercial solutions lack flexibility

Wi-Fi Provisioning System

ACES Solutions

Authentication

- Customizable authentication platform
- Works with different app vendor

Landing Page

- Clients can design/modify pages with simple drag & drop platform

Connectivity

- Wi-Fi provisioned
- Online connectivity is on

Thank You