SECTION 27 00 00 - TECHNOLOGY SYSTEMS NARRATIVE

PART 1 - GENERAL

1.1 SCOPE OF WORK

This portion of the technology systems scope of work generally covers the following systems, as referenced by the Venue Technology Systems Scope of Work and Implementation Matrix (attached). Other technology systems will be outlined in the AV narrative.

A. Demolition and Rework

B. Telecommunications Infrastructure

C. IT Systems:
   1. Telephone System
   2. Data Network System (LAN/WAN)
   3. Wireless Data Network System (WLAN/Wi-Fi)

D. Distributed Antenna Systems (DAS)

E. Security Systems

F. Audio/Visual Systems

G. Broadcast Infrastructure

H. Distributed Audio System

I. Distributed Video Systems

J. Large Format Video Systems and Production

K. Additionally, refer to the Electrical Systems Narrative and Mechanical Systems Narrative for additional requirements.

1.2 STANDARDS AND CODES

The technology systems planned for this venue shall be provided and installed to meet the National Electric Code (NEC), ANSI/EIA/TIA Standards, BICSI, NEMA, IEEE Standards, Owner and/or Building User standards, and other applicable codes/standards determined by Authority Having Jurisdiction (AHJ).

Provided below is a list of applicable standards and codes. Note there may be other applicable standards and codes.

A. ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.

B. ANSI/EIA/TIA-568-C.0: Generic Communications Cabling for Customer Premises.

C. ANSI/EIA/TIA-568-C.1: Commercial Building Communications Cabling Standards, Part 1: General Requirements.

D. ANSI/EIA/TIA-568-C.2: Balanced Twisted-Pair Communications Cabling and Components Standard.

E. ANSI/EIA/TIA-568-C.3: Optical Fiber Cabling Components Standard.

F. ANSI/EIA/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.

G. ANSI/EIA/TIA-606A: Administrative Standard for Commercial Telecommunications.

H. ANSI/EIA/TIA-607: Commercial Building Grounding and Bonding Requirements for Telecommunications.

I. BICSI CO-OSP Design Manual (current edition): Customer-Owned Outside-Plant Design Manual.

J. BICSI Network Design Reference Manual (current edition).

K. BICSI TDM Telecommunications Distribution Methods Manual (current edition).

L. BICSI Wireless Design Reference Manual (current).

M. EIA/TIA TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling.

N. IEEE-802.11 a, b, g, n, ac: Wireless Local Area Networks

O. IEEE-802.3: 10Mbps, 100Mbps, 1Gbps, and 10Gbps Ethernet Standards as applicable based on media types (twisted pair copper, fiber optics, etc.)

P. IEEE-802.3ak: 10Gbps Ethernet (evolving copper standard).

Q. IEEE-802.3af: Power-over-Ethernet (PoE).

R. IEEE 1100-1999: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.

S. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises.

T. NEMA Std 250: Enclosures for Electrical Equipment (1000 Volts Maximum).

U. NFPA-70/NEC: National Electrical Code.

V. NFPA-72: National Fire Alarm Signaling Code

W. USDA Bulletin 1751F-643: Underground Plant Design.

X. Other applicable codes, standards, and installation procedures consistent with recognized industry trends and generally accepted procedures.

Y. Professional Sports League Venue Standards: MLB, MLS, NBA, NFL, NHL as applicable.

PART 2 - DEMOLITION AND REWORK

2.1 The Arena interior is planned to be completely demolished with exception of structure, roof, and other major components. Refer to architectural and structural documents for extent of demolition and additional information.

2.2 The Arena has a significant underground telecommunications service feeding from the south into the arena. This include Seattle Center campus infrastructure as well as various telecom utility companies such as AT&T, DoIT, SC, i-Net, T-Mobile, etc.

2.3 The Arena also feeds or has telecom infrastructure that loops through to other adjacent Seattle Center Buildings. Any existing Seattle Center Building will need to be re-fed with a new telecom service entrance to each. Coordination with Seattle Center will be required to ensure complete uptime to removal of existing infrastructure to and within the Arena.

2.4 A detailed surveys and coordination will be required with Seattle Center and various Telecom Utility Companies to determine extent of routing to, within, and leaving the Arena.

PART 3 - TELECOMMUNICATIONS INFRASTRUCTURE

3.1 GENERAL

A. A new telecommunications (telecom) infrastructure system shall be provided to support voice and data applications/systems operated over a multi-media cabling plant including fiber optics and twisted pair copper.

B. This telecom infrastructure shall be supported by dedicated communication rooms and raceways. Communication rooms can also serve as a co-location for other technology and low voltage systems including AV, security, distributed antenna systems (DAS), and broadcast infrastructure. Additional coordination required as part of design and construction process.

C. Telecom infrastructure including cabling and raceways shall provide longevity to ensure future proofing. Cabling plant shall be the latest product available in the market, which meets latest standards with enhanced bandwidth capabilities and overhead. Raceways shall be provisioned to allow for a minimum of 20% spare physical capacity upon completion of facility. This will require a 30% initial design capacity to accommodate design changes to program.

3.2 TELECOMMUNICATIONS ROOMS

Dedicated communications rooms shall be provided as necessary to specifically support technology and other low voltage specific systems in this venue including a Telecom Demarc Rooms (TDR), Main Telecom Room (MTR), Data Center (DC), Telecom Rooms (TR), Telecom Cabinets (TC), Server Rooms, and Wireless Equipment Room (WER). Additionally, there will be League Technology Equipment Rooms including a NBA High-Speed Arena Network (HSAN) Room and NHL Server Room. Low voltage systems typically include voice, data, wireless, access control, video surveillance, DAS, audio/visual (AV), and sound systems.

Provided below is a list of communication room locations and quantities anticipated for this project. Additional TRs may be required on certain levels depending on building shape, layout, and coverage area.

1. Event: (1) MTR, (1) DC, (1) WER, (2) TDRs, (4) TRs, (1) NBA, (1) NHL
2. Mezzanine: (2-4) TRs
3. Main Concourse: (4) TRs
4. Club: (4) TRs
5. Suite: (4) TRs
6. Upper Concourse: (4) TRs
7. Press/Broadcast: (2) TRs
8. Catwalk: (4) TCs
9. Roof: None.

B. Communication Rooms shall be planned and fitted-out as follows:

1. Telecom Demarc Rooms(s):
The Telecom Demarcation Rooms (TDR) shall be provided for each primary and redundant service point of entry (POE). Additionally, these rooms will be used to terminate utilities service cables for demarcation and customer point of interface. The room shall be a minimum of 150ft2 (14m2) in size and may be divided into three smaller rooms (1-general, 1-telecom, and 1-video). All incoming utility service cables and demarcation terminals will be provided by the Service Provider.
TDRs shall be fitted out with the following systems, equipment, and hardware components:
   a. Flooring: Concrete floors shall be sealed to prevent dust build up and ease cleaning.
   b. Backboard: ¾-inch (19mm) AC-grade fire resistant plywood with white fire resistant paint on all sides, and mounted at 6 to 102-inches (150-2550mm) above finished floor (AFF) on all walls.
   c. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.
   d. Cable Tray: (1) 12-inch (300mm) wide wire (basket) or ladder rack type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm) AFF. Tray shall be offset 6-inches (150mm) from wall.
   e. Equipment Racks (Telecom):
      1) Racks: (1) 2-post 19-inch EIA equipment rack in 84-inch (2100mm) height with vertical cable/patch cord managers on each side.
      2) Power Units: (1) 1U horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V 13A (C13) outlets for each rack.
   f. Equipment Cabinets (Service Provider): (4-6) Equipment provided by Service Provider.
   g. Electrical:
      1) Telecom Load: 80 W/SF (10 kW Total excluding HVAC, Lighting, UPS)
      2) Redundancy: Not Required.
      3) Power Distribution:
         a) Normal Power: Non-critical components and non-code components shall be served from normal power. Distribution to receptacles shall originate from a 120/208V dedicated panel board shall be provided within room to serve all tele/data equipment within the room requiring normal power.
         b) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power. Distribution to outlets shall originate from a dedicated 120/208V panel board shall

be provided within room to serve all tele/data equipment within the room requiring emergency power.

4) Uninterruptible Power Supply (UPS):
Provide minimum 5kW UPS standalone unit mounted in Telecom Rack. Service Providers to provide other UPS or battery backup to support their equipment.

5) Circuits:
   a) HVAC Equipment: As required on generator power.
   b) Lighting: As required on generator power.
   c) Equipment Racks: (1) 120V 30A (NEMA L5-30R) and (1) 208V/30A (NEMA L6-30R) receptacles on generator power at each rack.
   d) Equipment Cabinets: (1) 120V 30A (NEMA L5-30R) and (1) 208V 30A (NEMA L6-30R) receptacles on generator power at each cabinet.
   e) UPS Connection: (1) 120/208V 50A (4-wire) hardwire from J-box.
   f) Distributed Antenna System (DAS): (2) 208V 30A (NEMA L6-30R) receptacles on generator power mounted on wall.
   g) Fire Alarm Panels: TBD
   h) Security System Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
   i) Door Hardware Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
   j) Distributed TV: (2) 120V 20A (NEMA 5-20R) quad-plex receptacles on normal power mounted on wall.
   k) AV System: (2) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on normal power.
   l) Misc. Equipment: (10) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.

6) Lighting: Fixtures as required for 50fc illumination with dedicated light switch.

h. Cooling/Heating:
   1) Load: 80 W/SF (10 kW Total excluding HVAC, Lighting, UPS)
   2) Redundancy: Not Required.
   3) System Type: Dedicated HVAC system (DX or Fan-Coil Unit) with dedicated thermostat located within the room.
   4) Operation Schedule: The system shall provide un-interruptible operation (24-hours per day and 365 days per year).
   5) Environment:
      a) Temperature: 68^{O} F (20^{o} C).
      b) Temp. Range: 65 to 75^{O} F (18 to 24^{O} C).
      c) Humidity: 30 to 50% RH,
      d) Air Changes: 1 ACH.
   6) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be dry chemical type with a high temperature pre-action type wet system with dry pipes.

2. Data Center (DC):
A DC shall be provided on a level above the recognized flood plain as determined by the Civil Engineer. Ideally this room should be located opposite side of building as Main Comm Room for diversity and redundancy of backbone infrastructure. The room shall be

a minimum of 720ft^2 (67m^2) in size and will be a mission critical facility and main equipment room for all major facility servers and computers. Additionally, it will be the main cross-connect for the (optional) redundant fiber optic backbone.

DC shall be fitted out with the following systems, equipment, and hardware components:

a. Raised Floor System: 24-inch (600mm) deep raised floor system with 24-inch (600mm) by 24-inch (600mm) panels to create a plenum for HVAC air distribution and power distribution. A recessed slab should be considered under raise floor area to eliminate requirement for ramp.

b. Backboard: ¾-inch (19mm) AC-grade fire resistant plywood with white fire resistant paint on all sides, and mounted at 6 to 102-inches (150-2550mm) above finished floor (AFF) on (1) wall.

c. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.

d. Cable Tray: (2) 18-inch (450mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm) and 114-inches (2750mm) AFF. Trays shall be offset 6-inches (150mm) from wall.

e. Equipment Racks:
   1) Racks: (4) 4-post 19-inch EIA equipment rack (19x32x84) in 84-inch (2100mm) height with 10-inch wide vertical cable/patch cord managers on each side.
   2) Future: (2) future equipment rack locations.
   3) Power Units: (1) 1U Horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U Horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V (C13) outlets for each rack.

f. Equipment Cabinets:
   1) Cabinets: (16) 4-post 19-inch EIA racks within enclosed equipment cabinets with outside dimensions of 24-inch wide by 42-inch depth by 84-inch height (600mm X 1020mm X 2100mm).
   2) Future: (4) future equipment cabinet locations.
   3) Power Units: (2) zero U vertical 5kW 208V 30A (NEMA L6-30P) metered PDU with (24) 208V 13A (C13), (6) 208V 19A (C19).

g. Electrical Power:
   1) Telecom Load: 110 W/SF (100 kW Total excluding HVAC, Lighting, UPS)
   2) Redundancy: N+1
   3) Distribution:
      a) Normal Power: Non-critical components and non-code components shall be served from normal power. Distribution to receptacles shall originate from a 120/208V panel board located in the Data Center.
      b) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system. Emergency (or stand-by) power shall feed a UPS system that will be connected to a dedicated 120/208V UPS panel board. Distribution to receptacles shall originate from the UPS panel board.
   4) Uninterruptible Power Supply (UPS): (2) UPS systems (A and B) of equal capacity to support telecom equipment. The size of each UPS shall be based on total estimated load and will feed dedicated 120/208V panel boards (A and B). All UPS equipment shall be interfaced to data network for monitoring by remote computer workstations.
   5) Emergency Power-Off Switch: EPO switch at room entrance for powering down all normal and emergency (or stand-by) power and UPS equipment. EPO switch shall be interfaced to fire alarm/suppression system for automatic shut-off or manual activation by Operator.

6) Circuits:
   a) HVAC Equipment: As required on generator power.
   b) Lighting: As required on generator power.
   c) Equipment Racks: (1) 120V 30A (NEMA L5-30R), (1) 208V/30A (NEMA L6-30R), and (3) 208V 20A (NEMA L6-20R) receptacles on UPS (A+B) power at each rack.
   d) Equipment Cabinets: (1) 120V 30A (NEMA L5-30R) and (2) 208V 30A (NEMA L6-30R) receptacles on UPS (A+B) power at each cabinet.
   e) UPS Connections: (2) hardwires from J-box.
   f) Fire Alarm Panels: TBD
   g) Security System Power Supply: (4) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
   h) Door Hardware Power Supply: (4) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
   i) Misc. Equipment: (30) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.
7) Lighting: Fixtures as required for 50fc illumination with dedicated light switch. Coordinate light fixtures with aisles between cabinets and racks to provide best illumination. Walls and surfaces should be painted white to increase illumination. Consider white cabinets and racks to further increase light levels.

h. Cooling/Heating:
1) Load: 110 W/SF (100 kW Total excluding HVAC, Lighting, UPS)
2) Redundancy: N+1
3) System Type: Dedicated computer room air conditioning (CRAC), HVAC systems (DX or Fan-Coil Units) with redundant unit(s). A dedicated thermostat shall be provided within the room.
4) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
5) Environment:
   a) Temperature: 68^{O} F (20^{o} C).
   b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
   c) Humidity: 30 to 50% RH,
   d) Air Changes: 1 ACH.
6) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be dry chemical type with a high temperature pre-action type wet system with dry pipes.

3. Main Telecom Room (MTR):

The MTR shall be provided on a level above the recognized flood plain as determined by the Civil Engineer. This room shall be located on opposite side of building from Data Center for diversity and redundancy of backbone infrastructure. The room shall be a minimum of $750ft^2$ ($70m^2$) in size and the structured cabling main cross-connect for all telecommunications and fiber optic backbone cable as well as the horizontal cross-connect (HC) for all local horizontal distribution in the area.

MTR shall be fitted out with the following systems, equipment, and hardware components:

a. Raised Floor System: 24-inch (600mm) deep raised floor system with 24-inch (600mm) by 24-inch (600mm) panels to create a plenum for HVAC air distribution and power distribution. A recessed slab should be considered under raise floor area to eliminate requirement for ramp.

b. Backboard: ¾-inch (19mm) AC-grade fire resistant plywood with white fire resistant paint on all sides, and mounted at 6 to 102-inches (150-2550mm) above finished floor (AFF) on (1) wall.

c. Grounding System: Telecom main ground bus (TMGB) connected to the telecom grounding backbone.

d. Cable Tray: (2) 18-inch (450mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm) and 114-inches (2750mm) AFF. Trays shall be offset 6-inches (150mm) from wall.

e. Equipment Racks:
   1) Racks: (8) 4-post 19-inch EIA equipment rack (19x32x84) in 84-inch (2100mm) height with 10-inch wide vertical cable/patch cord managers on each side.
   2) Future: (3) future equipment rack locations.
   3) Power Units: (1) 1U Horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U Horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V (C13) outlets for each rack.

f. Equipment Cabinets:
   1) Cabinets: (12) 4-post 19-inch EIA racks with enclosed equipment cabinets with outside dimensions of 24-inch wide by 42-inch depth by 84-inch height (600mm X 1020mm X 2100mm).
   2) Future: (4) future equipment cabinet locations.
   3) Power Units: (2) zero U vertical 5kW 208V 30A (NEMA L6-30P) metered PDU with (24) 208V 13A (C13), (6) 208V 19A (C19).

g. Electrical Power:
   1) Telecom Load: 110 W/SF (90 kW Total excluding HVAC, Lighting, UPS)
   2) Redundancy: N+1
   3) Distribution:
      a) Normal Power: Non critical components and non-code components shall be served from normal power. Distribution to receptacles shall originate from a 120/208V panel board located in the Data Center.
      b) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system. Emergency (or stand-by) power shall feed a UPS system that will be connected to a dedicated 120/208V UPS panel board. Distribution to receptacles shall originate from the UPS panel board.
   4) Uninterruptible Power Supply (UPS): (2) UPS systems (A and B) of equal capacity to support telecom equipment. The size of each UPS shall be based on total estimated load and will feed dedicated 120/208V panel boards (A and B). All UPS equipment shall be interfaced to data network for monitoring by remote computer workstations.
   5) Emergency Power-Off Switch: EPO switch at room entrance for powering down all normal and emergency (or stand-by) power and UPS equipment. EPO switch shall be interfaced to fire alarm/suppression system for automatic shut-off or manual activation by Operator.
   6) Circuits:
      a) HVAC Equipment: As required on generator power.
      b) Lighting: As required on generator power.

c) Equipment Racks: (1) 120V 30A (NEMA L5-30R), (1) 208V/30A (NEMA L6-30R), and (3) 208V 20A (NEMA L6-20R) receptacles on UPS (A+B) power at each rack.
d) Equipment Cabinets: (1) 120V 30A (NEMA L5-30R) and (2) 208V 30A (NEMA L6-30R) receptacles on UPS (A+B) power at each cabinet.
e) UPS Connections: (2) hardwires from J-box.
f) Distributed Antenna System (DAS): (4) 208V 30A (NEMA L6-30R) receptacles on generator power mounted on wall.
g) Fire Alarm Panels: TBD
h) Security System Power Supply: (4) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
i) Door Hardware Power Supply: (4) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
j) Distributed TV: (4) 120V 20A (NEMA 5-20R) quad-plex receptacles on normal power mounted on wall.
k) AV System: (4) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on normal power.
l) Misc. Equipment: (30) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.

7) Lighting: Fixtures as required for 50fc illumination with dedicated light switch. Coordinate light fixtures with aisles between cabinets and racks to provide best illumination. Walls and surfaces should be painted white to increase illumination. Consider white cabinets and racks to further increase light levels.

h. Cooling/Heating:
1) Telecom Load: 110 W/SF (90 kW Total excluding HVAC, Lighting, UPS)
2) Redundancy: N+1
3) System Type: Dedicated computer room air conditioning (CRAC), HVAC systems (DX or Fan-Coil Units) with redundant unit(s). A dedicated thermostat shall be provided within the room.
4) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
5) Environment:
a) Temperature: 68^{O} F (20^{o} C).
b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
c) Humidity: 30 to 50% RH,
d) Air Changes: 1 ACH.
6) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be dry chemical type with a high temperature pre-action type wet system with dry pipes.

4. Main Telecom Room (MTR)-**ALTERNATE**:
Providing alternate pricing for Owner review and proposal. Use MTR with combined Data Center on a level above the recognized flood plain as determined by the Civil Engineer. The room shall be a minimum of $950ft^2$ ($88m^2$) in size and the structured cabling main cross-connect for all telecommunications and fiber optic backbone cable. Additionally, network core switches will be located within this room as necessary to logically link Telecom Rooms (TRs) as well as all operators, team, and tenants' server equipment.

MTR shall be fitted out with the following systems, equipment, and hardware components:

a. Raised Floor System: 24-inch (600mm) deep raised floor system with 24-inch (600mm) by 24-inch (600mm) panels to create a plenum for HVAC air distribution and power distribution. A recessed slab should be considered under raise floor area to eliminate requirement for ramp.

b. Backboard: ¾-inch (19mm) AC-grade fire resistant plywood with white fire resistant paint on all sides, and mounted at 6 to 102-inches (150-2550mm) above finished floor (AFF) on (1) wall.

c. Grounding System: Telecom main ground bus (TMGB) connected to the telecom grounding backbone.

d. Cable Tray: (2) 18-inch (450mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm) and 114-inches (2750mm) AFF. Trays shall be offset 6-inches (150mm) from wall.

e. Equipment Racks:
   1) Racks: (10) 4-post 19-inch EIA equipment rack (19x32x84) in 84-inch (2100mm) height with 10-inch wide vertical cable/patch cord managers on each side.
   2) Spare: (4) future rack space
   3) Power Units: (1) 1U Horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U Horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V (C13) outlets for each rack.

f. Equipment Cabinets:
   1) Cabinets: (20) 4-post 19-inch EIA racks with enclosed equipment cabinets with outside dimensions of 24-inch wide by 42-inch depth by 84-inch height (600mm X 1020mm X 2100mm).
   2) Future: (4) future cabinet spaces
   3) Power Units: (2) zero U vertical 5kW 208V 30A (NEMA L6-30P) metered PDU with (24) 208V 13A (C13), (6) 208V 19A (C19).

g. Electrical Power:
   1) Telecom Load: 110 W/SF (105 kW Total excluding HVAC, Lighting, UPS)
   2) Redundancy: N+1
   3) Distribution:
      a) Normal Power: Non critical components and non-code components shall be served from normal power. Distribution to receptacles shall originate from a 120/208V panel board located in the Data Center.
      b) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system. Emergency (or stand-by) power shall feed a UPS system that will be connected to a dedicated 120/208V UPS panel board. Distribution to receptacles shall originate from the UPS panel board.
   4) Uninterruptible Power Supply (UPS): (2) UPS systems (A and B) of equal capacity to support telecom equipment. The size of each UPS shall be based on total estimated load and will feed dedicated 120/208V panel boards (A and B). All UPS equipment shall be interfaced to data network for monitoring by remote computer workstations.
   5) Emergency Power-Off Switch: EPO switch at room entrance for powering down all normal and emergency (or stand-by) power and UPS equipment. EPO switch shall be interfaced to fire alarm/suppression system for automatic shut-off or manual activation by Operator.
   6) Circuits:
      a) HVAC Equipment: As required on generator power.
      b) Lighting: As required on generator power.

c) Equipment Racks: (1) 120V 30A (NEMA L5-30R), (1) 208V/30A (NEMA L6-30R), and (3) 208V 20A (NEMA L6-20R) receptacles on UPS (A+B) power at each rack.
d) Equipment Cabinets: (1) 120V 30A (NEMA L5-30R) and (2) 208V 30A (NEMA L6-30R) receptacles on UPS (A+B) power at each cabinet.
e) UPS Connections: (2) hardwires from J-box.
f) Distributed Antenna System (DAS): (4) 208V 30A (NEMA L6-30R) receptacles on generator power mounted on wall.
g) Fire Alarm Panels: TBD
h) Security System Power Supply: (4) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
i) Door Hardware Power Supply: (4) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
j) Distributed TV: (4) 120V 20A (NEMA 5-20R) quad-plex receptacles on normal power mounted on wall.
k) AV System: (4) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on normal power.
l) Misc. Equipment: (30) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.

7) Lighting: Fixtures as required for 50fc illumination with dedicated light switch. Coordinate light fixtures with aisles between cabinets and racks to provide best illumination. Walls and surfaces should be painted white to increase illumination. Consider white cabinets and racks to further increase light levels.

h. Cooling/Heating:
1) Telecom Load: 110 W/SF (105 kW Total excluding HVAC, Lighting, UPS)
2) Redundancy: N+1
3) System Type: Dedicated computer room air conditioning (CRAC), HVAC systems (DX or Fan-Coil Units) with redundant unit(s). A dedicated thermostat shall be provided within the room.
4) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
5) Environment:
a) Temperature: 68^{O} F (20^{o} C).
b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
c) Humidity: 30 to 50% RH,
d) Air Changes: 1 ACH.
6) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be dry chemical type with a high temperature pre-action type wet system with dry pipes.

5. Telecom Rooms (TRs):
TRs will be used for backbone and horizontal distribution. Rooms shall be provided on all levels and areas requiring technology infrastructure and interfaces. TRs shall be approximately 120-140ft^2 (11-13m^2) in size and will be the structured cabling intermediate cross-connect (IC) for backbone/riser cable and the horizontal cross-connect (HC) for local horizontal distribution. TRs shall be located to maintain industry standard for horizontal cable length limits of 295-feet (90m). Generally, planned horizontal distribution

coverage requirements should not exceed 200-feet (61m) radii to account for vertical and horizontal traversing of cable to reach the communication device. TRs used on multiple levels shall be vertically aligned to form risers. TRs will also be used as technology co-location rooms for distribution and equipment such as audio video, distributed antenna systems (DAS), distributed television, door hardware power supplies, security systems, and sound system amps, etc.

Approximately (4) TR Risers are expected on this project type. Additional TRs may be required on certain levels depending on building shape, layout, and coverage area.

TRs shall be fitted out with the following systems, equipment, and hardware components:

a. Flooring: Concrete floors shall be sealed to prevent dust build up and ease cleaning.
b. Backboard: ¾-inch (19mm) AC-grade fire resistant plywood with white fire resistant paint on all sides, and mounted at 6 to 102-inches (150-2550mm) above finished floor (AFF) on all walls.
c. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.
d. Cable Tray: (2) 12-inch (300mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm) and 114-inches (2750mm) AFF. Trays shall be offset 6-inches (150mm) from wall.
e. Equipment Racks:
    1) Racks: (3) 4-post 19-inch EIA equipment racks (19x32x84) in 84-inch (2100mm) height with 10-inch wide vertical cable/patch cord managers on each side.
    2) Power Units: (1) 1U Horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U Horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V (C13) outlets for each rack.
f. Equipment Cabinets:
    1) Cabinets: (1) 4-post 19-inch EIA racks with enclosed equipment cabinets with outside dimensions of 24-inch wide by 32-inch depth by 84-inch height (600mm X 950mm X 2100mm) for AV systems.
g. Electrical Power:
    1) Telecom Load: 80 W/SF (16 kW Total excluding HVAC, Lighting, UPS)
    2) Redundancy: None.
    3) Distribution:
        a) Normal Power: Non critical components and non-code components shall be served from normal power.
        b) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system.
    4) Uninterruptible Power Supply (UPS): Provide minimum 8kW UPS standalone unit mounted in Telecom Rack.
    5) Circuits:
        a) HVAC Equipment: As required on generator power.
        b) Lighting: As required on generator power.
        c) Equipment Racks: (1) 120V 30A (NEMA L5-30R), (1) 208V/30A (NEMA L6-30R), and (1) 208V 20A (NEMA L6-20R) receptacles on generator power at each rack.
        d) UPS Connection: (1) 120/208V 50A (4-wire) hardwire from J-box.
        e) Distributed Antenna System (DAS): (2) 208V 30A (NEMA L6-30R) receptacles on generator power mounted on wall.
        f) Fire Alarm Panels: TBD
        g) Security System Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.

h) Door Hardware Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
i) Distributed TV: (2) 120V 20A (NEMA 5-20R) quad-plex receptacles on normal power mounted on wall.
j) AV System: (2) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on normal power.
k) Sound System: TBD on generator power mounted above cabinets.
l) Misc Equipment: (10) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.

6) Lighting: Fixtures as required for 50fc illumination with dedicated light switch.

h. Cooling/Heating:
1) Telecom Load: 80 W/SF (16 kW Total excluding HVAC, Lighting, UPS)
2) Redundancy: None.
3) System Type: Dedicated HVAC system HVAC systems (DX or Fan-Coil Units). A dedicated thermostat shall be provided within the room.
4) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
5) Environment:
a) Temperature: 68^{O} F (20^{o} C).
b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
c) Humidity: 30 to 50% RH,
d) Air Changes: 1 ACH.
6) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be wet type with a high temperature heads. A dry pre-action type system with dry pipes shall be provided when distributing to rooms at exterior locations.

6. Telecom Cabinet (TC):
TCs will be used at locations requiring backbone and horizontal distribution but without a dedicated TR.

TCs shall be fitted out with the following systems, equipment, and hardware components:

a. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.

b. Equipment Cabinet:
1) Cabinets: (1) 4-post 19-inch EIA racks with enclosed equipment cabinets with outside dimensions of 24-inch wide by 42-inch depth by 84-inch height (600mm X 1020mm X 2100mm) with internal vertical cable/patch cord managers on each side.
2) Power Units: (1) 1U Horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U Horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V (C13) outlets for each rack.

c. Electrical Power:
1) Telecom Load: 8 kW Total
a) Normal Power: Non critical components and non-code components shall be served from normal power.

b) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system.

2) Uninterruptible Power Supply (UPS): Provide 8kW UPS standalone unit mounted in Telecom Equipment Cabinet.

3) Circuits:

a) Equipment Cabinet: (1) 120V 30A (NEMA L5-30R), (1) 208V/30A (NEMA L6-30R), and (1) 208V 20A (NEMA L6-20R) receptacles on generator power at each rack.

b) UPS Connection: (1) 120/208V 50A (4-wire) hardwire from J-box.

4) Lighting: None.

d. Cooling/Heating: None dedicated. Use ambient air.

e. Plumbing: None.

f. Fire Protection: None.

7. Wireless Equipment Room (WER):

The WER (also called DAS Room) shall be provided on a level above the recognized flood plain as determined by the Civil Engineer. The room shall be a minimum of 1400ft^2 (130m^2) in size and co-location of main wireless equipment to support distributed antenna system (DAS) head-end, public safety radio head-end, and cellular carrier BTS equipment. The exact size of this room will vary depending on Cellular Carrier requirements.

a. Flooring: Concrete floors shall be sealed to prevent dust build up and ease cleaning.

b. Backboard: ¾-inch (19mm) AC-grade fire resistant plywood with white fire resistant paint on all sides, and mounted at 6 to 102-inches (150-2550mm) above finished floor (AFF) on (1) wall.

c. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.

d. Cable Tray: (2) 18-inch (450mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm) and 114-inches (2750mm) AFF. Trays shall be offset 6-inches (150mm) from wall.

e. (Telecom) Equipment Racks:

1) Racks: (1) 4-post 19-inch EIA equipment rack (19x32x84) in 84-inch (2100mm) height with vertical cable/patch cord managers on each side.

2) Future: (3) future rack spaces.

3) Power Units: (1) 1U Horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U Horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V (C13) outlets for each rack.

f. (DAS Head-End) Equipment Cabinets:

1) Cabinets: (10) 4-post 19-inch EIA racks with enclosed equipment cabinets with outside dimensions of 24-inch wide by 42-inch depth by 84-inch height (600mm X 1020mm X 2100mm).

2) Future: (4) future cabinet spaces.

3) Power Units: (2) zero U vertical 5kW 208V 30A (NEMA L6-30P) metered PDU with (24) 208V 13A (C13), (6) 208V 19A (C19).

g. Carrier Equipment Racks/Cabinets: All equipment racks required for base station, power plants, batteries, and cross-connects, etc. to be provided by cellular carriers including AT&T, Verizon Wireless, Sprint, T-Mobile, and others, etc. Exact quantities and requirement will vary.

h. Electrical Power:

1) Telecom Load: 110 W/SF (160 kW Total excluding HVAC, Lighting, UPS)Redundancy: N+1

2) Distribution:
   a) DAS Equipment and HVAC: (1) 120/208V 400A metered panel-board served from generator power.
   b) Cellular Carrier Equipment: (4) 120/208V 200A metered panel-board served from generator power.
3) Uninterruptible Power Supply (UPS): Provide 8kW UPS standalone unit mounted in Telecom Rack. Other UPS equipment required for DAS Head-End and Cellular BTS equipment to be provided by DAS vendor and Cellular Carriers.
4) Circuits:
   a) HVAC Equipment: As required on generator power.
   b) Lighting: As required on generator power.
   c) Telecom Equipment Racks: (1) 120V 30A (NEMA L5-30R), (1) 208V/30A (NEMA L6-30R) and (3) 208V 20A (NEMA L6-20R) receptacles fed from DAS Equipment Distribution Panel at each rack.
   d) DAS Equipment Cabinets: (1) 120V 30A (NEMA L5-30R) and (2) 208V 30A (NEMA L6-30R) receptacles fed from DAS Equipment Distribution Panel at each cabinet.
   e) Cellular Equipment Cabinets: Distribution, Receptacles and equipment connections shall be performed by Cellular Carriers and/or DAS vendor from Cellular Equipment Distribution Panel.
   f) UPS Connections: (2) hardwires from J-box.
   g) Security System Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
   h) Door Hardware Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
   i) Misc. Equipment: (10) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.
5) Lighting: Fixtures as required for 50fc illumination with dedicated light switch.

i. Cooling/Heating:
   1) Telecom Load: 110 W/SF (160 kW Total excluding HVAC, Lighting, UPS)Redundancy: N+1
   2) System Type: Dedicated computer room air conditioning (CRAC), HVAC systems (DX or Fan-Coil Units) with redundant unit(s). A dedicated thermostat shall be provided within the room.
   3) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
   4) Environment:
      a) Temperature: 68^{O} F (20^{o} C).
      b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
      c) Humidity: 30 to 50% RH,
      d) Air Changes: 1 ACH.
   5) Electrical: All HVAC equipment shall be circuited on generator power.

j. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

k. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be dry chemical type with a high temperature pre-action type wet system with dry pipes.

8. Server Room(s):
Dedicated Server Rooms may be required to support for various building tenants and/or

user groups including ticketing, food service, retail/merchandising, and facility operations. Server Rooms shall be approximately 90ft^2 (8.5m^2) in size. Requirements for rooms and associate support system need to reviewed and coordinated during design process.

Server Rooms shall be fitted out with the following systems, equipment, and hardware components:

a. Flooring: Concrete floors shall be sealed to prevent dust build up and ease cleaning.
b. Backboard: ¾-inch (19mm) AC-grade fire resistant plywood with white fire resistant paint on all sides, and mounted at 6 to 102-inches (150-2550mm) above finished floor (AFF) on (1) wall.
c. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.
d. Cable Tray: (1) 12-inch (300mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm) AFF. Trays shall be offset 6-inches (150mm) from wall.
e. Equipment Racks:
    1) Racks: (1) 4-post 19-inch EIA equipment rack in 84-inch (2100mm) height with vertical cable/patch cord managers on each side.
    2) Power Units: (1) 1U Horizontal 2.9kW 120V 30A (NEMA L5-30P) metered PDU with (24) 120V 20A (NEMA 5-20) outlets and (1) 1U Horizontal 5.0kW 208V/30A (NEMA L6-30P) metered PDU with (4) 208V 19A (C19) and (6) 208V (C13) outlets for each rack.
f. Equipment Cabinets:
    1) TBD. Provided by Tenant.
g. Electrical Power:
    1) Telecom Load: 80 W/SF (10 kW Total excluding HVAC, Lighting, UPS)
    2) Redundancy: None.
    3) Distribution:
        a) Normal Power: Non critical components and non-code components shall be served from normal power. Distribution to receptacles shall originate from a 120/208V panel board located in the Data Center.
        b) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system. Emergency (or stand-by) power shall feed a UPS system that will be connected to a dedicated 120/208V UPS panel board. Distribution to receptacles shall originate from the UPS panel board.
    4) Uninterruptible Power Supply (UPS): Standalone UPS to be provided by system vendors.
    5) Circuits:
        a) HVAC Equipment: As required on generator power.
        b) Lighting: As required on generator power.
        c) Equipment Racks: (1) 120V 30A (NEMA L5-30R), (1) 208V/30A (NEMA L6-30R), and (1) 208V 20A (NEMA L6-20R) receptacles on generator power at each rack.
        d) Equipment Cabinets: (1) 120V 30A (NEMA L5-30R) and (2) 208V 30A (NEMA L6-30R) receptacles on generator power at each cabinet.
        e) UPS Connection: (1) 120/208V 50A (4-wire) hardwire from J-box.
        f) Fire Alarm Panels: TBD
        g) Security System Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
        h) Door Hardware Power Supply: (2) 120V 20A (3-wire) hardwire from J-box on generator power mounted on wall.
        i) AV System: (2) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on normal power.

j) Misc. Equipment: (8) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.

6) Lighting: Fixtures as required for 50fc illumination with dedicated light switch.

h. Cooling/Heating:
1) Telecom Load: 80 W/SF (10 kW Total excluding HVAC, Lighting, UPS)
Redundancy: None.
2) System Type: Dedicated HVAC system HVAC systems (DX or Fan-Coil Units). A dedicated thermostat shall be provided within the room.
3) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
4) Environment:
a) Temperature: 68^{O} F (20^{o} C).
b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
c) Humidity: 30 to 50% RH,
d) Air Changes: 1 ACH.
5) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be wet type with a high temperature heads. A dry chemical or pre-action type system with dry pipes shall be proposed as an alternate for consideration by Tenant and Owner.

9. NBA High-Speed Arena Network (HSAN) Room:
A dedicated room for the NBA HSAN equipment will be provided on the Event Level within 250-feet of Broadcast Truck Compound and 300-feet of Scorers Table. HSAN Room shall be $250ft^2$ ($23m^2$).

HSAN Room shall be fitted out with the following systems, equipment, and hardware components:

a. Flooring: Concrete floors shall be sealed to prevent dust build up and ease cleaning.
b. Backboard: None.
c. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.
d. Cable Tray: (1) 12-inch (300mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm).
e. Equipment Racks:
1) Racks: (3) 4-post 19-inch EIA equipment racks (19x32x84) in 84-inch (2100mm) height with vertical cable/patch cord managers on each side.
2) Power Units: None.
f. Equipment Cabinets: None.
g. Electrical Power:
1) Telecom Load: 80 W/SF (16 kW Total excluding HVAC, Lighting, UPS)
2) Redundancy: None.
3) Distribution:
a) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system.
4) Uninterruptible Power Supply (UPS): Provide 8kW UPS standalone unit mounted in Telecom Rack.

5) Circuits:
   a) HVAC Equipment: As required on generator power.
   b) Lighting: As required on generator power.
   c) Equipment Racks: (2) 120V 20A (NEMA L5-20R) and (2) 120V 30A (NEMA L5-30R) receptacles on generator power at each rack.
   d) UPS Connection: (1) 120/208V 50A (4-wire) hardwire from J-box.
   e) Misc. Equipment: (4) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.
6) Lighting: Fixtures as required for 50fc illumination with dedicated light switch.

h. Cooling/Heating:
   1) Telecom Load: 80 W/SF (16 kW Total excluding HVAC, Lighting, UPS)
   2) Redundancy: N+1
   3) System Type: Dedicated HVAC system HVAC systems (DX or Fan-Coil Units). A dedicated thermostat shall be provided within the room.
   4) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
   5) Environment:
      a) Temperature: 68^{O} F (20^{o} C).
      b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
      c) Humidity: 40 to 60% RH,
      d) Air Changes: 1 ACH.
   6) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be wet type with a high temperature heads. A dry pre-action type system with dry pipes shall be provided when distributing to rooms at exterior locations.

10. NHL Equipment Room:

A dedicated room for the NHL equipment will be provided on the Event Level. NHL Server Room shall be approximately $250ft^2$ ($23m^2$).

NHL Equipment Room shall be fitted out with the following systems, equipment, and hardware components:

a. Flooring: Concrete floors shall be sealed to prevent dust build up and ease cleaning.
b. Backboard: None.
c. Grounding System: Telecom ground bus (TGB) connected to the telecom grounding backbone.
d. Cable Tray: (1) 12-inch (300mm) wide wire (basket) type cable tray mounted around room perimeter and sections above equipment racks at 90-inches (2150mm).
e. Equipment Racks:
   1) Racks: (3) 4-post 19-inch EIA equipment rack (19x32x84) in 84-inch (2100mm) height with vertical cable/patch cord managers on each side.
   2) Power Units: None.
f. Equipment Cabinets: None.
g. Electrical Power:
   1) Telecom Load: 80 W/SF (16 kW Total excluding HVAC, Lighting, UPS)
   2) Redundancy: None.

3) Distribution:
   a) Generator Power: Mission critical components and Life Safety/Code components shall be served from generator power and UPS system.
4) Uninterruptible Power Supply (UPS): Provide 8kW UPS standalone unit mounted in Telecom Rack.
5) Circuits:
   a) HVAC Equipment: As required on generator power.
   b) Lighting: As required on generator power.
   c) Equipment Racks: (2) 120V 20A (NEMA L5-20R) and (2) 120V 30A (NEMA L5-30R) receptacles on generator power at each rack.
   d) UPS Connection: (1) 120/208V 50A (4-wire) hardwire from J-box.
   e) Misc. Equipment: (4) 120V 20A (NEMA 5-20R) quad-plex receptacles mounted on wall equally spaced.
6) Lighting: Fixtures as required for 50fc illumination with dedicated light switch.

h. Cooling/Heating:
1) Telecom Load: 80 W/SF (16 kW Total excluding HVAC, Lighting, UPS)
2) Redundancy: N+1
3) System Type: Dedicated HVAC system HVAC systems (DX or Fan-Coil Units). A dedicated thermostat shall be provided within the room.
4) Operation Schedule: Un-interruptible operation (24-hours per day and 365 days per year).
5) Environment:
   a) Temperature: 68^{O} F (20^{o} C).
   b) Temp. Range: 66 to 72^{O} F (18.8 to 22.2^{O} C).
   c) Humidity: 40 to 60% RH,
   d) Air Changes: 1 ACH.
6) Electrical: All HVAC equipment shall be circuited on generator power.

i. Plumbing: Under no conditions shall any pressurized water piping be routed through this room. Additionally, any gravity piping such as waste lines and roof drain lines should not be routed through this room, however; if it is not possible to meet this condition then drip pans with drain lines shall be provided below all piping or a waterproof membrane installed above entire room complete with perimeter drain system.

j. Fire Protection: Necessary smoke detectors and sprinkler systems that meet all applicable codes established by the AHJ. Sprinkler system shall be wet type with a high temperature heads. A dry pre-action type system with dry pipes shall be provided when distributing to rooms at exterior locations.

3.3 SERVICE ENTRANCE

A. Primary Telecom Service:
A Primary Telecom Service Entrance to accommodate Seattle Center campus infrastructure as well as Telecom Utility Service Infrastructure such as telephone, data, Internet, CATV, TV Broadcast Fiber Uplink, and other services. Primary entrance will include a dedicated communications manhole(s) with a minimum of (10) 4-inch (100mm) underground conduits routed from Primary TDR to property line as coordinated with Telecom Service Providers. Manhole shall be a minimum of 4-foot x 8-foot x 6.5-foot (1.2m x 2.4m x 2m) base/cover size with access cover, grounding rod, sump, cable racking, ladder and hardware package. All conduits shall each be installed with three (3) 1-inch (25mm) corrugated fiber optic inner-ducts.

B. Diverse Telecom Service Entrance:
A Diverse Telecom Service Entrance shall be provided for service reliability and redundancy. Diverse entrance shall include a minimum of (8) 4-inch (100mm) conduits from Redundant TDR to dedicated manhole, and maintain a minimum of 30-feet (10m) separation from the Primary

Service. Manhole, conduits, inner-ducts, and other components shall be equivalent as primary service.

3.4 TELECOMMUNICATIONS GROUNDING SYSTEM

A dedicated telecommunications ground system with insulated bonding backbones (TBB), equalizing conductors (TEC), and pre-drilled tinned copper busses (TMGB and TGB) shall be provided at each telecommunications room including TDRs, MTR, DC, TRs, TCs, WER, Server Rooms, NBA, and NHL to bond metallic equipment and hardware components. System shall be based on and compliant with ANSI/EIA/TIA-607 Standard requirements.

Provided below are general components and associated requirements:

A. Telecom Main Ground Bus (TMGB):
(2) 20-inch x 4-inch x ¼-inch (500mm x 100mm x 6mm) tinned copper bus pre-drilled) mounted on wall with isolated stand-offs at 18-inches (450mm) at the MTR and WER. The TMGB shall be connected to the main electrical service ground bus with an insulated #3/0 (120mm^2) stranded grounding conductor installed in continuous conduits. Additionally, the TMGB shall be connected to building steel if existing within room.

B. Telecom Ground Bus (TGB):
(1) 20-inch x 4-inch x ¼-inch (500mm x 100mm x 6mm) tinned copper bus pre-drilled) mounted on wall with isolated stand-offs at 18-inches (450mm) at each TR, TC and Server Rooms. The TGB shall be connected to the telecommunications bonding backbone (TBB), to the nearest electrical ground bus at electrical room providing distribution to TR,TC and Server Room, and connected to building steel if existing within room using an insulated #3/0 (120mm^2) stranded grounding conductor installed in continuous conduits.

C. Telecommunications Bonding Backbone (TBB):
All TGBs on the lowest level of the facility shall be connected to the TMGB with insulated #3/0 (120mm^2) stranded grounding conductor installed in continuous conduits or cable tray. TGBs located in TR riser rooms shall be vertically connected using a single insulated #3/0 (120mm^2) stranded grounding conductor installed in continuous conduits up through riser and connected to each TGB using a #3/0 tap conductor bonded to the backbone using an irreversible, high compression fitting.

D. Equalizing Conductors:
All TGBs on the lowest level, the highest level, and every third level in between shall be horizontally connected in loop type topology using an insulated #3/0 (120mm^2) stranded grounding conductor installed in continuous conduits.

E. Equipment Grounding:
All metallic technology components and infrastructure shall be bonded to nearest telecom ground bus (TGB) as per building code, industry standard, manufacturer's requirements, and accepted industry practices. Components typically include but not limited to cable tray, ladder racks, equipment racks/cabinets, metallic cable sheaths, conduits, conduit sleeves, raised floor support system, and modular equipment chassis, etc.

3.5 BUILDING INFRASTRUCTURE

This building shall be installed with dedicated raceway and cable systems specifically for technology and low voltages systems.

A. Raceway Systems:

1. Backbone Raceways:
   TRs shall be vertically interconnected with a minimum of (18) 4-inch (100mm) conduits and/or sleeves (or provisions for equivalent vertically mounted cable tray with slab block-outs through floors using pre-manufactured fire-rated sleeves) for routing technology backbone infrastructure including AV, broadcast, data, fire alarm, POS, security, sound, telephone, TV, and wireless cables, etc. where feasible and as dictated by cable quantity.
2. Horizontal Raceway:
   Conduits and/or cable trays shall be routed horizontally out of all telecom rooms and closets to allow horizontal or workstation distribution to enter room for routing technology backbone and horizontal infrastructure including AV, broadcast, data, fire alarm, POS, security, sound, telephone, TV, and wireless cables, etc. where feasible and as dictated by cable quantity. Conduits shall be a minimum of (18) 4-inch conduits (or equivalent fill as cable tray) routed continuously to reach corridors or concourses. All conduits routed through electrical rooms shall be continuous to minimize risk of interference on low voltage systems. Additionally, continuous conduits shall be extended above all concourses and other exposed public areas.
3. Cable Tray:
   Cable trays shall be aluminum ladder type or wire type (basket). Solid bottom tray shall be provided at all locations with open ceilings exposed to public view. Enclosed tray shall be used for segments routed through electrical rooms or other areas posing electrical or radio interference. Cable trays will be routed horizontally on various levels in corridors and concourses to interconnect TRs for routing technology horizontal infrastructure including AV, broadcast, data, fire alarm, POS, security, sound, telephone, TV, and wireless cables, etc. where feasible and as dictated by cable quantity.

   Cable tray shall be 6-inches (150mm) deep with varying widths and shall be generally provided as noted at the following locations. Refer to Technology Drawings for additional information on cable tray types and exact routing.
   a. Event: (2) 24-inch (600mm) trays (ladder and solid bottom) around main service corridor (loop) and spurs to TDR, DC, MTR, WER, and each TR.
   b. Main Concourse: (1) 18-inch (450mm) tray (solid bottom) around main corridor (loop) and spurs to each TR.
   c. Club Concourse: (1) 18-inch (450mm) tray (solid bottom) around main corridor (loop) and spurs to each TR.
   d. Suite: (1) 18-inch (450mm) tray (solid bottom) around main corridor (loop) and spurs to each TR.
   e. Upper Concourse: (1) 18-inch (450mm) tray (solid bottom) around main corridor (loop) and spurs to each TR.
   f. Broadcast Press: (1) 24-inch (600mm) tray (solid bottom) around main corridor (loop) and spurs to each TR.
   g. Catwalk: (1) 12-inch (300mm) tray (wire type)
   h. Administrative Office Areas: (1) 12-inch (300mm) tray (wire type) above ceilings with spurs to nearest TR.

4. Telecom Device Raceway:
   Each location to have 2-gang (double-deep) back-box with single gang mounting plate (mud ring) and ¾-inch (19mm) for 2-cables or less and 1-inch (25mm) for 3-cables or more minimum conduits originating from accessible ceiling area or cable tray. Provide continuous conduits segments through all inaccessible areas, areas exposed to public view such as concourses and other sensitive architectural areas. Use j-hooks mounted

at 48-inch (1200mm) spacing not served by conduit or cable tray. Conduit sleeves and/or continuous segments shall be provided through walls for unimpeded pathway to cable origin or cable tray. All conduit penetrations and opening through fire rated walls shall be sealed with appropriate fire and smoke stop material. All raceway and cable routing shall be located to minimize cable length.

Certain telecom devices may require multiple conduits, larger conduits, and/or larger enclosures based on cable fill. Devices that require enclosures (as noted below) shall have a 22-inch x 22-inch x 8-inch (550mm x 550mm x 200mm) stainless steel enclosure with (1) 2-inch minimum conduits routed to the nearest cable tray or communications room.

5. Structured Cabling System:
The communications infrastructure shall consist of a structured cabling system using physical hierarchical star cable topology comprised of backbone/riser and horizontal distribution segments.
   a. Campus Distribution
      1) Telecommunications Copper:
         Requirements to be confirmed by Seattle Center.
      2) Fiber Optics:
         Requirements to be confirmed by Seattle Center.
   b. Backbone Distribution :
      1) Telecommunications Copper:
         Minimum (1) 25-pair Cat. 3 cable (to support conventional analog/digital telecommunications) routed to each TR to MTR. Cable shall be terminated using rack mounted 24-port RJ45 patch panel with 1-pair per jack on pins #4/5. Horizontal patch cord managers should be provided above and below patch panels. Actual backbone cable sizes to be confirmed during design.
      2) Fiber Optics-Primary:
         Minimum (1) 12-strand OM4 multi-mode and (1) 36-strand OS2 single-mode fiber optic backbone cable routed to each TR to MTR. Cable shall be terminated using duplex LC connectors with rack mounted 2U or 144-port fiber enclosures.
      3) Fiber Optics-Redundant:
         Minimum (1) 12-strand OM4 multi-mode and (1) 36-strand OS2 single-mode fiber optic backbone cable (diversely routed from primary backbone) to each TR to DC. Cable shall meet equivalent performance and termination requirements as primary.
   c. Server Cabinet Interconnects:
      Provide (1) 24-strand OM4 multi-mode and (1) 24-strand OS2 single-mode fiber optic cable routed to each Server Cabinet from Fiber Main Cross-Connect Race within room. Cable shall be terminated using duplex LC connectors with rack mounted 2U or 144-port fiber enclosures.
   d. Other Equipment Room Interfaces:
      Tie cables shall be provided to each of the following equipment rooms with backbone cable originating from MTR. Cable shall meet equivalent performance and termination requirements as backbone cable segments.
      1) Data Center: (1) 36-strand OM4 multi-mode and (1) 96-strand single-mode OS2 fiber optic cables from MTR.
      2) Telecom Demarc Rooms (TDR): (1) 100-pair Cat 3 cable and (1) 12-strand OM4 multi-mode and (1) 96-strand single-mode fiber optic cables to each Primary TDR and Redundant TDR from MTR.
      3) Production Room: (1) 12-strand OM4 multi-mode and (1) 36-strand single-mode OS2 fiber optic cables from MTR.
      4) Security Command Center: (1) 25-pair Cat 3 cable and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables from MTR.

5) Scoreboard Control Room: (1) 12-strand OM4 multi-mode and (1) 36-strand single-mode OS2 fiber optic cables from MTR.
6) Tenant Server Rooms: (1) 25-pair Cat 3 cable and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables from MTR.
7) TV Broadcast Truck Compound/Head-End: (1) 100-pair Cat 3 cable and (1) 12-strand OM4 multi-mode and (1) 36-strand OS2 single-mode fiber optic cables from MTR.
8) Video Control Room: (1) 12-strand OM4 multi-mode and (1) 36-strand single-mode OS2 fiber optic cables from MTR.
9) Wireless Equipment Room: (1) 100-pair Cat 3 cable and (1) 12-strand OM4 multi-mode and (1) 96-strand single-mode OS2 fiber optic cables from MTR.

e. Remote Unit Interfaces:
Tie cables shall be provided to each of the following remote unit locations with backbone cable originating from MTR. Cable shall meet equivalent performance and termination requirements as backbone cable segments.
1) AV Equipment Room or Rack: (12) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR.
2) Catwalk: (12) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR. (4-total)
3) Courtside: (24) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR. (3-total on scoring/press side, 1-total at opposite side)
4) Multi-Purpose Room: (12) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR.
5) Green Room: (12) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR.
6) Guard Shack: (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR.
7) Locker Rooms: (12) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR.
8) Press Interview Room: (12) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 12-strand single-mode OS2 fiber optic cables to MTR.
9) Sound System/Amp Rooms: (12) Cat. 6A 4-pair to nearest TR and (1) 12-strand OM4 multi-mode and (1) 36-strand single-mode OS2 fiber optic cables to MTR.

f. NBA HSAN Backbone:
Per current NBA Arena Standards.

g. NHL Backbone:
Per current NHL Arena Standards.

h. Horizontal Distribution – Telephone and Data:
Distribution from endpoint telecom devices shall use 4-pair UTP as noted below originating from nearest TR. Cable shall not exceed total cable length of 295-feet (90m). Cable shall terminate using equivalent RJ45 jacks in modular stainless faceplates at end points and rack mounted 48-port RJ45 patch panels at TR. Patch panels to be provided as necessary with horizontal patch cord managers above and below each panel. Anticipated quantities of certain devices and cables are shown below. Exact requirements to be finalized.
1) (8) Automatic Teller Machine: (1) Cat6A, (ATM)
2) (100) AV Device: (6) Cat6A, (AV)
3) (625) Data Comm/LAN: (2) Cat6A, (DATA)
4) (10) Elevator Cabs: (6) OS2 or (4) Cat6A for telephone, TV, security cam, and Wi-Fi, (ELEV)

5) (4) Elevator Machine Rooms: (6) Cat6A for control, telephone, TV, security cam, and Wi-Fi, (ELEVMACH)
6) (24) Escalator Pits: (2) Cat6A for control, (ESC)
7) (tbd) Remote Media Hub: (12) OM4, (12) OS2, (12) Cat6A, (MEDIA)
8) (1000) IP Television: (1) Cat6A, (IPTV)
9) (incl w/IP Television) IP Menu Boards: (1) Cat6A, (IPTV)
10) (incl w/IP Television) IP Signage: (1) Cat6A, (IPTV)
11) (tbd) NBA HSAN: (2) Cat6A (HSAN)
12) (tbd) NHL Data: (2) Cat6A (NHL)
13) (400) Point-of-Sale(POS): (3) Cat6A, (POS)
14) (incl w/POS) Portable POS: use WLAN (PPOS)
15) (400) Security Camera: (1) Cat6A, (CAM)
16) (8) Time Clock: (1) Cat6A, (TIME)
17) (300) Wall Mounted Telephone: (1) Cat6A, (TELE)
18) (800) Wireless LAN/Wi-Fi: (2) Cat6A, (WLAN2)

*****Device quantities shown are for reference only based on similar venue types. Exact requirements to be coordinated with owner.***

i. Telecom Device Power:
Telecom devices shall each be installed with 120V, 20A (NEMA 5-20R) quad-plex receptacle with exception Wall Tele, WLAN, Security Cam, etc. Each POS device shall be installed with isolated ground type duplex outlet. Public Tele requires a junction-box with hardwired 120V 20A circuit.

3.6 PROGRAM REQUIREMENTS

The following room and area types are proposed to have comm devices as specified:

A. Base Program Requirements:
Provided below are general communications program requirements. Device cables quantities and locations shall be provided as necessary based on applications and density.

1. Administrative Offices=CAM, DATA, IPTV, WLAN
2. AHU=DATA, TELE
3. Auxiliary Locker Rooms=CAM, DATA, IPTV, WLAN
4. Bar=AV, CAM, IPTV, POS, TELE, WLAN
5. Beer Room=DATA, TELE
6. Boiler Room=DATA, TELE
7. Bowl AHU=DATA, TELE
8. Broadcast Camera Positions=AV
9. Broadcast Truck Compound and Parking=CAM, HSAN, MEDIA, WLAN
10. Chiller Plant=DATA, TELE
11. Circulation=WLAN, CAM
12. Clubs=CAM, IPTV, POS, PPOS, TELE, WLAN
13. Commissary=CAM, DATA, IPTV, POS, TELE
14. Concessions=CAM, IPTV, POS, TELE
15. Concession Prep=POS, TELE
16. Concourses=AV, CAM, IPTV, MEDIA, POS, PPOS, TELE, WLAN
17. Conference Rooms=AV, DATA, IPTV, TELE, WLAN
18. Control Room=AV, DATA, MEDIA, TELE, WLAN
19. Corridor=CAM, WLAN
20. Courtside= DATA, HSAN, TELE, WLAN
21. Elec Rooms=DATA, TELE
22. Elevators=CAM, ELEV, IPTV, TELE
23. Elevator Lobbies=CAM, WLAN

24. Employee Entrance=CAM, DATA, TIME, WLAN
25. Entrances=CAM, WLAN
26. Escalators=CAM, WLAN
27. Exits=CAM, WLAN
28. Event Floor=DATA, MEDIA, TELE, WLAN
29. Event Locker Room=DATA, IPTV, TELE, WLAN
30. Event Offices=DATA, IPTV, TELE, WLAN
31. Family=DATA, IPTV, TELE, WLAN
32. Fan Accommodations=DATA, TELE, WLAN
33. Fire Command Center=DATA, TELE, WLAN
34. First Aid=DATA, WLAN
35. Food Service Locker Room=DATA, IPTV, TELE, WLAN
36. Green Rooms=DATA, MEDIA, TELE, WLAN
37. Home Locker Room=AV, CAM, DATA, IPTV, MEDIA, TELE, WLAN
38. Ice Plant=DATA, TELE
39. Interview Room=DATA, HSAN, IPTV, MEDIA, TELE, WLAN
40. Kiosk=DATA
41. Kitchen/Commissary=CAM, DATA, IPTV, POS, TELE, WLAN
42. Loading Dock=CAM, DATA, TELE, WLAN
43. Lobby=CAM, DATA, IPTV, WLAN
44. Main Lobby=CAM, DATA, IPTV, WLAN
45. Maintenance Area=DATA, IPTV, TELE, WLAN
46. Marshalling=CAM, DATA, WLAN
47. Mech Rooms=DATA, TELE
48. Novelty=CAM, DATA, IPTV, TELE, WLAN
49. Officials Area=DATA, HSAN, IPTV, TELE, WLAN
50. Offices=CAM, DATA, IPTV, WLAN
51. Operations=CAM, DATA, IPTV, WLAN
52. Pantry=POS, WLAN
53. Parking (office)=CAM, TELE, WLAN
54. Parking (player)=CAM, TELE, WLAN
55. Parking (public)=CAM, TELE, WLAN
56. Party Suite=AV, DATA, IPTV, TELE, TIX, WLAN
57. Plaza Areas=CAM, MEDIA, TELE, WLAN
58. Portable POS Carts=PPOS, WLAN
59. Press Areas=TELE, WLAN
60. Press Work Room=DATA, IPTV, TELE, WLAN
61. Production Studio=AV, DATA, TELE, WLAN
62. Radio Broadcast Booth= AV, DATA, IPTV, TELE, WLAN
63. Receiving=DATA, IPTV, TELE, WLAN
64. Reception=DATA, IPTV, TELE, WLAN
65. Recycling/Trash=CAM
66. Restrooms=WLAN
67. Retail=CAM, DATA, TELE, WLAN
68. Seating Bowl=CAM, WLAN
69. Security Command=DATA, MEDIA, TELE, WLAN
70. Service Tunnel/Corridors=CAM, DATA, MEDIA, WLAN
71. Sponsor Suite=AV, DATA, IPTV, TELE, TIX, WLAN
72. Sponsor Zone=DATA, IPTV, MEDIA, WLAN
73. Stadium Exterior=CAM, MEDIA, WLAN
74. Staff Entrance=CAM, DATA, IPTV, TIME, WLAN
75. Stairs=CAM, WLAN
76. Stair Towers=WLAN
77. Star Dressing=DATA, IPTV, TELE, WLAN
78. Storage=TELE, WLAN
79. Suites=AV, DATA, IPTV, TELE, TIX, WLAN

80. Team Store= CAM, DATA, IPTV, TELE, WLAN
81. Telecom Rooms=TELE
82. Terrace=CAM, MEDIA, POS, WLAN
83. Ticketing=CAM, DATA, IPTV, MEDIA, TELE, WLAN
84. Ticketing Lobby=CAM, DATA, IPTV, WLAN
85. Ticketing Office=CAM, DATA, IPTV, TELE, WLAN
86. Ticket Window=CAM, DATA, IPTV, WLAN
87. Trash/Recycling=(none)
88. Trash/Recycling Dock=CAM, WLAN
89. TV Broadcast Booth=AV, DATA, IPTV, TELE WLAN
90. Uniform=DATA, IPTV, TELE, WLAN
91. Vault/Safe=CAM
92. Vendor Commissary=POS, TELE, WLAN
93. Vending=POS, TELE, WLAN
94. Video Control Room=AV, DATA, MEDIA, TELE, WLAN
95. VIP Entrance=DATA, IPTV, TELE, WLAN
96. Visiting/Aux Locker Rooms=AV, CAM, DATA, IPTV, MEDIA, TELE, WLAN
97. Vomitory=CAM, DATA, MEDIA, WLAN
98. Work Room=DATA, TELE, WLAN
99. Writing Press Area=DATA, TELE, WLAN
100. X-Ray Room=DATA, TELE, WLAN
101. Zamboni=TELE

B. Optional Program Requirements:
   1. To be confirmed during design.

PART 4 - IT-SYSTEMS

4.1 GENERAL

A. This work and design to be developed in conjunction with Owner and Tenants.

B. IT Systems include IP Telephone, Wireless Data Network, and Converged Data Network.

C. Verification required with Owner how this work will be procured and implemented.

4.2 TELEPHONE SYSTEM

A. General
   1. Provide a complete and fully functional IP Telephone System.
   2. Telephone System to be provided based on industry best practices.
   3. Telephone System shall be a single system to support all facility tenants and users.
   4. Telephone System will be IP type and use the converged data network for Ethernet/IP connectivity throughout facility.

B. Equipment and Components
   1. The telephone systems shall include but not be limited to the following components:
      a. Call Servers (primary and redundant)
      b. Unified Messaging Servers
      c. E911 Servers (primary and redundant)
      d. XML and Applications Servers
      e. Telephone Desk Sets
      f. Conference Telephones

g. Wall Mounted Telephone
h. Attendant Console using computer workstation and touch panel display.
i. Attendant Console using Button Expansion Module
j. Gateways, Routers, and Firewalls
k. Patch Cords
l. TDD Device
m. Analog Voice Gateways
n. Soft Phone Software
o. System, Application and User Software and Firmware

C. Program Requirements
1. The telephone system shall be a single system that supports all facility tenants and users including the following:
a. Admin Offices
b. Broadcast and Press Areas
c. Facility Operations
d. Food Service Offices, Concessions, and Bars
e. League Areas
f. Multi-Purpose Areas
g. Officials Areas
h. Retail Offices and Stores
i. Security Operations
j. Team Areas and Offices
k. Ticketing Offices and Call Center
l. Writing Press Areas
2. Telephone Desk Sets shall have 2-port 1Gbps Ethernet switch for connecting peripheral devices such as computer workstations and printers.
3. Full XML applications development with all necessary software and hardware for deployment on the telephone handsets. Applications shall include Owner Branding, Tenant/User Branding, full IPTV system control of local devices, Internet browser, and future development of food service menus, retail, and other POS integration.

4.3 WIRELESS DATA NETWORK (WLAN/WI-FI)

A. General
1. Provide a complete and fully functional Wireless Data Network (WLAN / Wi-Fi).
2. Wireless Data Network to be Enterprise grade system based on industry best practices.
3. The Wireless Data Network shall be a converged network that provides a single wireless data and backbone connectivity for all building systems, applications, tenants, and user. Virtual local area networks (VLANs) shall be integrated into the system to virtually secure and segment the network.
4. The Wireless Data Network will use the converged data network for Ethernet/IP connectivity throughout facility.
5. Wireless Data Network shall provide ubiquitous coverage of venue including back-of-house, public, seating bowl, field, parking lots, plazas, and surrounding exterior areas.
6. Wireless Data Network shall use a high-density layout and configuration in public areas including entrance portals, concourses, clubs, suites, and seating bowl.

B. Equipment and Components
1. The wireless data network shall be a complete system and include the following major equipment and components:
a. Wireless Controllers (primary and redundant)
b. Gateways and Routers
c. Wireless Access Points (WAPs)
d. Mobility Service Equipment (MSE)

e. Services Control Engine (SCE)
f. Intelligent Services Gateway (ISG)
g. Wireless Intrusion Prevention System (WIPS)
h. Antennas
i. Enclosures
j. Specialty Enclosures (hand rails)
k. Patch Cords (fiber and copper)

C. Program Requirements
1. Wireless Data Network shall comply with IEEE 802.11ac Wave2 or higher using 2.4 and 5.0GHz frequencies.
2. Each WAP coverage shall cover no more than (100) seats or people.
3. Take rate and bandwidth requirements shall be based on 100% Active Connected Users at 10Mbps per user.
4. The Wireless Data Network shall use primary and redundant Wireless Controllers.
5. The Wireless Data Network will be converged connectivity for all building systems, applications tenants, and users into a single. Dedicated SSIDs will be setup for the following:
   a. Administration
   b. AV Systems
   c. Broadcast and Press
   d. Facility Operations
   e. Food Service
   f. League Areas
   g. Multi-Purpose Areas
   h. Officials Areas
   i. POS
   j. Public Internet
   k. Retail Service
   l. Security Operations
   m. Team Administration
   n. Ticket Scanners
   o. Ticketing System
   p. Writing Press
6. Wireless Data Network shall provide ubiquitous coverage throughout venue and surrounding exterior areas including but not limited to the following:
   a. Admin Office Areas
   b. Broadcast Truck Compound
   c. Club Areas
   d. Command Centers
   e. Concourses
   f. Service Corridors
   g. Concession Stands
   h. Comm Rooms
   i. Corridors
   j. Electrical Rooms
   k. Elevator Cabs
   l. Entrances and Exits
   m. Escalators
   n. Exterior Building Areas
   o. Loading Dock
   p. Lobbies
   q. Locker Rooms
   r. Mechanical Rooms
   s. Multipurpose\Green\Interview Rooms
   t. Novelty Stands

u. Pantries
v. Parking Lots (Exterior)
w. Playing Field Area
x. Plaza Areas (Exterior)
y. Production Studio
z. Retail Team Stores
aa. Receiving Areas
bb. Seating Bowl
cc. Security Command Center
dd. Storage Rooms
ee. Suites
ff. Stair Towers
gg. Ticket Window Areas and Offices
hh. TV/Radio Broadcast Booths
ii. Video Control Room
jj. Vending Areas
kk. Work Rooms
ll. Writing Press Area

4.4 CONVERGED DATA NETWORK

A. General
1. Provide a complete and fully functional Data Network.
2. Data Network to be Enterprise grade system based on industry best practices.
3. The Data Network shall be a converged data network that provides a single data network and backbone connectivity for all building systems, applications, tenants, and user. Virtual local area networks (VLANs) shall be integrated into the system to virtually secure and segment the network.

B. Equipment and Components
1. The data network shall be a complete system and include the following major equipment and components:
a. Core Switches (primary and redundant)
b. Access Switches
c. Routers
d. Firewalls and VPN Licenses
e. DMZ Switches
f. Domain Name Servers (primary and redundant)
g. Network Monitoring and Management Equipment and Software
h. Software and Firmware
i. Dedicate UPS at each IC-Rooms
j. Patch Cords (fiber and copper)

C. Program Requirements
1. The Data Network shall use primary and redundant Core Switches interfaced to Access Switches with primary and redundant uplinks using fiber optic backbone cable.
2. Primary and redundant uplink bandwidth shall each be a minimum of fully duplexed 10-Gbps Ethernet. Additional bandwidth may be required including 40-Gbps and 100-Gbps for various locations depending on load.
3. Primary Core Switch will be installed at Main Comm Room and Redundant Core Switch at Data Center. Both Primary and Redundant to be installed at Main Comm Room if no Data Center present on project or later removed.
4. Each Core Switch shall have redundant components including power supplies, supervisors, and uplinks.

5. Access Switches shall be 24-port and/or 48-port 10/100/1000 Mbps copper Ethernet ports. Modular chassis should be considered when switch count exceeds (4) stackable switches. Stack cables shall be provided to interconnect back-planes of switches at IC-Rooms.
6. Layer-2 and Layer-3 Access Switches will be provided at each IC-Room.
7. Access Switch quantity will be based on providing connectivity based on a minimum of 1-port for each telecom device plus 20%.
8. Access Switches shall have redundant uplinks and power supplies.
9. The Data Network will converge connectivity for all building systems, applications tenants, and users into a single. Virtual local area networks (VLANs) shall be integrated into the system to virtually secure and segment these networks. VLANs will be setup with Class of Service (CoS) and Quality of Service (Qos). VLANs will include the following:
    a. Admin Data (Computers, Printers, Servers)
    b. Advertising Panels
    c. AV Systems
    d. Building Management Systems (BMS)
    e. BMS Controllers
    f. Distributed Sound System
    g. Food Service Tenant
    h. IP Telephone
    i. IPTV
    j. League
    k. Point of Sale (POS)
    l. Security Cameras
    m. Security Controllers
    n. Security Management System (SMS)
    o. Team
    p. Tenants
    q. Ticketing System
    r. Wireless Ticket Scanners
    s. Wireless POS
    t. Wireless LAN (WLAN)
    u. Wireless Public Internet
    v. Other data communications to be determined

PART 5 - DISTRIBUTED ANTENNA SYSTEM (DAS)

5.1 GENERAL

A. There shall be two DAS systems, one shall be a neutral host that supports multiple cellular carriers. The second shall support emergency responder (police, fire, ambulance) two-way radios, and operations (facility, event) two-way radios.

B. DAS Vendor shall coordinate with Owner or Owners radio provider for provision of appropriate frequencies and repeaters for two-way radio systems.

C. DAS Vendor to provide a complete and fully functioning and supported neutral host DAS including equipment, installation, support, and maintenance.

D. The DAS shall include an in-building and exterior system. Exterior system requirements need to be coordinated with Cellular Carriers.

E. DAS shall provide ubiquitous coverage of venue including back-of-house, public, seating bowl, field, parking lots, plazas, and surrounding exterior areas.

F. A dedicated DAS room (Wireless Equipment Room) shall be provided to support DAS, cellular carriers, and public safety equipment. DAS room shall have all MEP support systems including air conditioning, power, UPS, telecom ground, and fire suppression. Refer to Telecommunications Rooms Section for additional requirements.

G. The DAS Vendor scope of work shall be for a complete and fully functioning DAS system including but not limited to wireless surveys, technical design, procurement, installation, cellular carrier coordination, and full support and maintenance of system. These elements of this scope shall include all necessary components and infrastructure such as DAS head-end, fiber optic backbone, remote units, antennas, antenna cables, horizontal raceway, and miscellaneous power distribution.

H. The DAS Vendor shall provide options for installation, funding, and procurement as well as disclosure revenue opportunities as part of the Vendor's proposal response.

I. The DAS Vendor shall be responsible for providing a neutral host DAS that will support all major and local Cellular Carrier signals. The Contractor shall be solely responsible for negotiating and coordinating all legal agreements, technical requirements, utility costs, and financial/revenue obligations of each Cellular Carriers.

J. The DAS shall support the following Cellular Carriers:
   1. AT&T
   2. Verizon Wireless
   3. Sprint
   4. T-Mobile
   5. Other local carriers TBD

K. The DAS shall be an in-building wireless system and exterior wireless system for supporting frequencies in the 450 to 2500 MHz range and expandable to support emerging technologies up to 6000 MHz.

L. DAS Vendor shall provide all detailed coordination of antenna placement for approval by Owner and Architect. Work shall include all necessary concealment, stealthing, facades, and painting to hide equipment including antennas, cables, raceway, remote units, and any other exposed equipment.

M. Equipment and Components
   1. Wireless Equipment Room (DAS Room)
      a. Refer to Comm Room Section for requirements.
   2. DAS Equipment
      a. Head-End
      b. Equipment Cabinets and Racks
      c. Tele/Data Cables
      d. Fiber Optic Backbone and Cross-Connect
      e. Raceways
      f. Remote Units
      g. Power Plants
      h. Battery Backup
      i. Power Cables
      j. Splice Components
      k. Splitters, Couplers, Combiners, and Filters
      l. Amplifiers
      m. Antenna Cables

n. Antennas
o. Enclosures

3. Concealment
   a. Painting
   b. Facades
   c. Enclosures
   d. Stealthing
4. Software
5. PSTN and Internet Connectivity

N. Program Requirements
1. The DAS shall support all frequencies currently used by national and local Cellular Carriers including the following current technologies:
   a. AT&T: LTE-1900 (MIMO)
   b. AT&T: LTE-700 (MIMO)
   c. AT&T: LTE-2100 (MIMO)
   d. AT&T: UMTS-850
   e. AT&T: UMTS-1900
   f. Verizon: CDMA-850
   g. Verizon: EVDO-1900
   h. Verizon: LTE-700 (MIMO)
   i. Verizon: LTE-2100 (MIMO)
   j. Sprint: CDMA-800
   k. Sprint: CDMA-1900
   l. Sprint: iDen-900
   m. Sprint: LTE-1900
   n. T-Mobile: GSM-1900
   o. T-Mobile: LTE-2100
   p. T-Mobile: UMTS-1900
   q. T-Mobile: UMTS-2100
   r. T-Mobile/MetroPCS: CDMA-1900
2. DAS shall provide ubiquitous coverage throughout venue and surrounding exterior areas including but not limited to the following:
   a. Admin Office Areas
   b. Broadcast Truck Compound
   c. Club Areas
   d. Command Centers
   e. Concourses
   f. Service Corridors
   g. Concession Stands
   h. Comm Rooms
   i. Corridors
   j. Electrical Rooms
   k. Elevator Cabs
   l. Entrances and Exits
   m. Exterior Building Areas
   n. Loading Dock
   o. Lobbies
   p. Locker Rooms
   q. Mechanical Rooms
   r. Multipurpose\Green\Interview Rooms
   s. Novelty Stands
   t. Pantries
   u. Parking Lots (Exterior)
   v. Playing Field Area
   w. Plaza Areas (Exterior)

x. Production Studio
y. Retail Team Stores
z. Receiving Areas
aa. Seating Bowl
bb. Security Command Center
cc. Storage Rooms
dd. Suites
ee. Stair Towers
ff. Ticket Window Areas and Offices
gg. TV/Radio Broadcast Booths
hh. Video Control Room
ii. Vending Areas
jj. Work Rooms
kk. Writing Press Area

PART 6 - SECURITY SYSTEM

6.1 GENERAL

A. Provide a complete and fully functional integrated security system utilizing electronic access control, intrusion detection, and video surveillance.

B. The security system shall incorporate hardware and software specifically designed to support multi-systems, multi-users, multi-tasking point monitoring and system administration and operation.

C. The systems shall be interfaced to the facility LAN using Ethernet and Internet Protocol (IP) based technology.

6.2 EQUIPMENT AND COMPONENTS

System equipment and components shall be provided as necessary and include the following major components as noted below. Preliminary device quantities are shown in parenthesis for certain equipment and devices. Exact requirements to be finalized.

A. Infrastructure
1. Cable
2. Raceway
3. Power
4. Battery Backup

B. Command Center Furniture
1. Command Center console for (2) Security Operators
2. Desk for (1) Security Manager
3. Desk for (1) Security Director
4. Work Area Counter for (10) Event Day Security Staff/Emergency Personnel

C. Computers
1. Command Center Console: (2) Computers with (4) 22-inch displays each and UPS.
2. Security Manager Desk: (1) Computer with (2) 22-inch displays, Laser Printer, and UPS.
3. Security Director Desk: (1) Computer with (2) 22-inch displays, Laser Printer, and UPS.
4. Event Day Command Center: (2) Computers with (3) 22-inch displays, (1) 22-inch “touch panel” display each, and UPS.

5. Command Center Video Wall: (2) Computers with (3) HD video outputs.
6. Security Admin Desks: (2) Computers with (2) 22-inch displays each with Web Cam, ID/Photo Badge Color Printer, Laser Printer, Driver's License Scanner, Finger Print Scanner, Card Reader device, and UPS.

D. Video Wall
1. Command Center: 2x3-Type with 65-inch displays and (10) HD video input AV control system, touch-panel, and UPS.
2. War Room: 2x3-Type with 65-inch displays and (10) HD video input AV control system, touch-panel, and UPS.

E. Servers
1. Network Video Recorders (30-days motion at 15-IPS)
2. Video Archive SAN Servers (60-days motion at 15-IPS)
3. Video Tape Backup and Servers (LTO8 or higher)
4. Access Control System Servers

F. Software
1. Access Control System
2. Video Surveillance System
3. Integrated Graphical User Interface (GUI) System
4. Video Analytics (optional for Owner consideration)
5. Archive and Backup Systems
6. UPS Monitoring

G. Inspection Equipment (provided by Owner)
1. X-Ray Machines
2. Magnetometers
3. Hand-held Metal Detector Wands

H. Security Equipment and Devices
1. Command Center Console, Video Wall, AV System Controller, Report Printer, Computer Workstations, and UPS (CONSOLE)
2. Security Computer Workstations and UPS, (COMPUTER)
3. User ID Issuance Workstation, Video Camera, Card Printer, and UPS, (ID)
4. Visitor Management System, Computer Workstation, Video Camera, Badge Printer, and UPS, (VMS)
5. (12) Two-Way Intercom Systems (INTERCOM)
6. (tbd) Code Blue Telephones (BLUE TELE)
7. Access Control System, Server and UPS, (ACS)
8. Video Surveillance System, Servers, Video Archive Server/Tape, and UPS (CCTV)
9. Network Video Recorders and UPS, (NVRs)
10. Security Control Panel and UPS, (SCP)
11. (8) Biometric/Card Reader Time Clock System (TC)
12. (12) Biometric/Smart Card/Proximity Readers, (BR)
13. (300) Smart Card/Proximity Readers, (CR)
14. (100) Controlled Electric Lock Zones (EL)
15. (500) Door Status Monitors, (M)
16. (25) Duress Button, (PANIC)
17. (400) 2-5MP 180 Fixed Cameras (solid state), (CAM-F)
18. (24) 2-5MP 360 Fixed Cameras (solid state), (CAM-360)
19. (42) 16-20MP HD Fixed Cameras (solid state), (CAM-HD)
20. (6) PTZ Cameras, (CAM-PTZ)
21. All necessary cable, raceways, terminations, and panels, etc.
22. (75) Ticket Bar Code Scanner/Reader (TIX)
23. (6) Biometric Time Clock and Check-In System (TC)

*****Device quantities shown are for reference only based on similar venue types. Exact requirements to be coordinated with owner.***

I. Security Device Raceways:
Each location to have 2-gang (double-deep) back-box with single gang mounting plate (mud ring) and 1-inch (25mm) (1) 1-1/4 inch (32mm) minimum diameter conduit originating from accessible ceiling area or cable tray. Provide continuous conduits segments through all inaccessible areas, areas exposed to public view such as concourses and other sensitive architectural areas. Use j-hooks mounted at 48-inch (1200mm) spacing not served by conduit or cable tray. Conduit sleeves and/or continuous segments shall be provided through walls for unimpeded pathway to cable origin or cable tray. All conduit penetrations and opening through fire rated walls shall be sealed with appropriate fire and smoke stop material. All raceway and cable routing shall be located to minimize cable length.

6.3 PROGRAM REQUIREMENTS

The following room locations and/or area types are proposed to have security devices as specified below. Additionally, all security devices installed in exterior (or wet) conditions shall be weather-proof grade.

A. Base Program Requirements:
1. Administrative Offices= BR, CAM-180, CR, EL, INTERCOM, M
2. AHU=CR, M
3. Auxiliary Locker Rooms=CAM-180, CR, M
4. Bar=CAM-F
5. Beer Room=(none)
6. Boiler Room=DATA, TELE
7. Bowl AHU=DATA, TELE
8. Broadcast Camera Position=(none)
9. Broadcast Truck Compound and Parking=CAM-F, CR
10. Chiller Plant=CR, M
11. Circulation=CAM-180
12. Clubs=CAM-180, M
13. Commissary=CR, M
14. Concessions=CAM-180
15. Concession Prep=(none)
16. Concourses=CAM-180
17. Conference Room=(none)
18. Control Room=BR, M
19. Corridor=CAM-180
20. Courtside=(none)
21. Elec Rooms=CR, M
22. Elevators=CAM-180, CR
23. Elevator Lobbies=CAM-180
24. Employee Entrance=CAM-180, CR, M, TIME
25. Entrances= BR, CAM-180, CR, EL, M
26. Escalators=CAM-180
27. Exits=CAM-180, M
28. Event Floor=CAM-HD
29. Event Locker Room=(none)
30. Event Offices=CR, M
31. Family=(none)
32. Fan Accommodation=(none)
33. First Aid=(none)

34. Fire Command Center=CR, M
35. Food Service Locker Room=(none)
36. Green Rooms=CAM-F, CR, M
37. Home Locker Room=CAM-180, CR, M
38. Ice Plant=CR, M
39. Interview Room=(none)
40. Kiosk=(none)
41. Kitchen/Commissary=CAM-180, CR, M
42. Loading Dock=CAM-180, CAM-PTZ, BR, M
43. Lobby=CAM-180, CR, M
44. Main Lobby=CAM-360, CAM-180, CR, EL, M
45. Maintenance Area=CAM-180, CR, M
46. Marshalling=CAM-180
47. Mech Rooms=CR, M
48. Officials Area=CAM-180, CR, M
49. Offices= BR, CAM-180, CR, EL, INTERCOM, M
50. Operations=CAM-180, CR, ID, M, WORKSTATION, VMS
51. Pantry=M
52. Parking (office)=BLUE-TELE, CAM-180, CAM-360, CR, INTERCOM
53. Parking (player)=BLUE-TELE, CAM-180, CAM-360, CR, INTERCOM
54. Parking (public)=BLUE-TELE, CAM-180, CAM-360
55. Party Suite=TIX
56. Plaza Areas=BLUE-TELE, CAM-180, CAM-360
57. Portable POS Carts=(none)
58. Press Areas=WORKSTATION
59. Press Work Room=(none)
60. Pub=CAM-180, CR, M
61. Grounds Keeping=CAM-180, CR, M
62. Radio Broadcast Booth=(none)
63. Receiving=CAM-180, CR, M
64. Reception=CAM-180, CR, M
65. Recycling/Trash=CAM-F, M
66. Restrooms=(none)
67. Retail=CAM-180, CR, M, PANIC
68. Seating Bowl=CAM-HD
69. Security Command=CAM-180, CONSOLE, CR, ID, M, VMS
70. Service Tunnel/Corridors=CAM-180
71. Sponsor Suite=TIX
72. Sponsor Zone=(none)
73. Stadium Exterior=CAM-360, CAM-180
74. Staff Entrance=BR, CAM-180, CR, M, TIME
75. Stadium Exterior=CAM-180, CAM-360, CR, M
76. Stairs=CAM-180
77. Stair Towers=M
78. Star Dressing=(none)
79. Storage=M
80. Suites=TIX
81. Team Store=CAM-180, CR, M
82. Telecom Rooms=ACS, CCTV, CR, NVR, M, SCP
83. Terrace=CAM-180
84. Ticketing=CAM-180, CR, M, PANIC
85. Ticketing Lobby=CAM-180, CR, M
86. Ticketing Office=CAM-180, DATA, IPTV, TELE, WLAN
87. Ticket Window=CAM-180, PANIC
88. Trash/Recycling=(none)
89. Trash/Recycling Dock=CAM-180, M

90. TV Broadcast Booth=(none)
91. Uniform=(none)
92. Vault/Safe=BR, CAM-180, CR, M
93. Vendor Commissary=CR, M
94. Vending=(none)
95. Video Control Room=BR, CAM-180, M
96. VIP Entrance=CAM-180, CR, M
97. Visiting/Aux Locker Rooms=CAM-180, CR, M
98. Vomitory=CAM-180
99. Work Room=(none)
100. Writing Press Area=(none)
101. X-Ray Room=CR, M
102. Zamboni=(none)

B. Optional Program Requirements:
   1. To be confirmed during design.

PART 7 - AUDIO/VISUAL SYSTEMS

7.1 GENERAL

A. Provide specialty AV systems including local AV touch panel controls and systems, speakers, distributed audio interface, local AV user interfaces, etc. AV touch panels shall provide local control including volume and source selection.

B. Locker Rooms:
   1. Provide a local audio interface for space users to input their own audio source from portable music player or other media device.
   2. Provide for the option of a dedicated audio equipment to be added in local equipment rack for dedicated audio gear.
   3. Provide a local voice override for overhead announcements from a local user within each locker room to allow for voice enhancement for presentations or group meetings.

C. Training Areas:
   1. Provide a local audio interface for space users to input their own audio source from portable music player or other media device.

D. Clubs:
   1. Provide for a dedicated AV switcher for TV's and projectors within the space. Switcher shall have inputs to support the IPTV system media player in addition to local inputs and a DVD/Blu-ray player.
   2. Provide a local audio interface for space users to input their own audio source from portable music player or other media device.
   3. Provide for the option of a dedicated audio equipment to be added in local equipment rack for dedicated audio gear like an XM radio or other media player.
   4. Provide a local voice override for overhead announcements from a local user within each locker room to allow for voice enhancement for presentations or group meetings.
   5. Provide projectors and screens as noted in drawings. Projectors shall be fed from local inputs within space to allow for a laptop or other media device to display content on the screens.
   6. Include interface to local lighting and shade control and coordinate interface and control requirements with Electrical contractor.

E. Suites:
1. Suites shall have TV's capable of local input from laptops or other devices. Local audio override or volume control of overhead audio system shall be independent of TV.

F. Conference Rooms:
1. Provide for a dedicated AV switcher for room displays.
2. Provide an interface plate below the display as well as coordinated with furniture to allow for laptops and other media devices to be put up on TV.
3. Provide local control from a wall mounted touch panel.
4. Each conference room shall support no less than (3) inputs from various sources to be coordinated. Assume one source will be mounted behind the TV and require IR override to control. (ex. Apple TV, Roku, and other media players)

7.2 EQUIPMENT AND COMPONENTS

A. Each space shall be provided with a local switcher, amplifier and DSP to provide for local override and control of audio and video within each space. Provide channels and interface ports as required to provide a full functioning system.

B. Touch Panels:
1. Provide Touch Panel in each space with a dedicated AV switcher a touch panel interface shall be provided to allow for control of AV equipment, inputs and outputs.
2. In team and Owner spaces AV switchers shall be provided with a wireless option and mount within wall.

C. Racks:
1. Provide a wall mounted or millwork mounted equipment rack for large systems for Clubs and Locker rooms.
2. Provide ceiling mounted plenum rated rack and equipment for conference rooms.

D. Interfaces and Cabling: Provide for all cabling and interfaces as required to provide a fully functional system. Coordinate and confirm all requirements prior to ordering and installation.

PART 8 - BROADCAST INFRASTRUCTURE

8.1 GENERAL

A. Provide dedicated radio, television, and ENG broadcast passive infrastructure including cable, terminations, and raceways per NBA and NHL Venue Standards requirements. Cable shall originate from each end-point and be continuous to TV broadcast truck compound or in house production suite.

B. Raceway only shall be provided to ENG and satellite uplink parking areas. Cable requirements to be confirmed with local ENG broadcasters.

8.2 EQUIPMENT AND COMPONENTS

A. Broadcast Enclosures: Broadcast boxes shall be fully weather rated with locking in-use covers. Each box shall have a swinging 19-inch EIA mounted rack to allow cable terminations to be swung out or down for termination / servicing.

B. Broadcast Truck Parking: Provide interior parking for (6) National TV Trucks at Loading Dock and exterior parking for (12) ENG/SAT TV Trucks in adjacent parking lot or street. Exact locations to be confirmed.

C. Truck Dock Interface: Provide for a (8) fully enclosed NEMA-4X rated 19-inch EIA 19x30x84-inch high equipment racks for termination of building broadcast cabling and other broadcast related equipment. Enclosure shall be pad mounted with space to access cabling from behind. Each rack shall have an individually coiling roll up door with in-use locks to allow for broadcast cabling to be patch and interfaced. Refer to drawings for location. Label all racks and panels with vinyl etched name plate, black with white lettering.

D. Satellite Uplink / Broadcaster Pedestals: Provide for (4) full enclosed NEMA-4X rated 19-inch EIA 19x30x36-inch high equipment racks within freestanding pedestals for termination of uplink truck or local broadcast cabling. Each pedestal shall be pad mounted to protect from incidental flooding. Refer to drawings for location and additional details. Label all racks and panels with vinyl etched name plate, black with white lettering.

E. Cabling: Provide enterprise grade and warrantied broadcast cabling. Each cable shall be continuous from the individual box location back to TV truck compound or Production room. Every cable shall be terminated and tested with full testing reports provided to Owner and manufacturer for cable warranties. Cable shall include but not limited to Triax, Single-Mode Fiber, SMPTE, Audio, RF Coax, Cat6A dry pairs, and Cat6A data cables and associated terminations.

8.3 PROGRAM REQUIREMENTS

A. Refer to drawings for cabling requirements and termination locations

B. Cabling, terminations and enclosure guidelines shall comply with NBA and NHL Venue Standards and industry best practice.

PART 9 - DISTRIBUTED AUDIO SYSTEM

9.1 GENERAL

A. Provide a full building distributed audio system based on networked audio and distributed speaker clusters and amplifier rooms.

B. System shall also be rated to provide life safety and emergency announcements. Confirm requirements and coordinate with AHJ as necessary.

C. The sound system will be able to provide average direct sound pressure levels greater than the level of a loudly cheering crowd. Under normal operating conditions, the sound system will provide 90dBA SPL coverage to the audience area with capability to reach up to 106 dBA SPL if required. If ambient crowd noise microphones are implemented, automatic control of volume may be available such that all announcements and program material are consistently at least 10dB greater than the overall background loudness of the crowd.

D. All loudspeakers and clusters will be coordinated to receive signal in a staggered fashion to minimize the amount of time between direct and indirect sound. All sound arrivals within 15dB of the direct sound should be within a 30 ms time frame.

E. Audience areas served by the loudspeaker clusters should be uniform within ±3 dB from across the critical frequencies for speech intelligibility (350 Hz to 4KHz). Audience members in the lowest rows of seats may experience slightly less low-frequency and high-frequency reproduction in non-critical frequencies for speech intelligibility, up to 3 dB compared to the upper most row, depending on how the system is equalized.

F. Throughout the entire seating bowl, the sound system will be able to provide an average minimum STI score of 0.71 (considered very good on the STI scale of 0.0 to 1.0, in accordance to IEC 60268-16). This value equates to 90-94% of words spoken and broadcasted over the system to be intelligible for the average audience member.

G. Although speech intelligibility and sound quality are closely linked, they are not mutually inclusive. It is possible to have a great sound system have poor intelligibility, and vice versa. While the described system offers performance comparable or greater to most modern stadiums, high-profile concerts that utilize any section of the seating bowl will likely require supplemental loudspeakers.

H. Both the seating bowl sound system and other interior sound systems operate on a digital audio network emanating from the main PA and Production Control Room. Connection points into the digital audio network are located at various points within the stadium, including the field wall, camera platforms, event spaces, etc. Processing and routing of digital audio is done through networked digital signal processors (DSPs). DSPs in the control room are used to enhance and route the audio throughout the facility. DSPs throughout the stadium (TRs, Club spaces, AV closets, etc.) are used to receive and distribute the audio to the amplifiers which power the loudspeakers.

I. Authorized users shall have the ability to selectively feed any/all audio sources (including microphones, media players, message repeaters, radio/TV tuners, etc.) to any/all loudspeaker locations via the networked DSPs. Depending on the configuration, networked DSPs may be controlled via the mixing console, computers, web-enabled devices, and/or touch-panels anywhere in the stadium.

9.2 EQUIPMENT AND COMPONENTS

A. The Seating Bowl Sound System will be a distributed system comprising of 6-8 speaker clusters mounted from roof structure as well as numerous loudspeakers mounted at high elevations throughout the seating bowl to cover lower and upper seating sections.

B. Delay fill speakers will be required in the upper seating areas. These speakers will be integrated with the Seating Bowl Sound System.

C. Speakers integrated with the Seating Bowl Sound System will also be located throughout the public concourses and restrooms.

D. Provide workstation, mix console, and microphone setup for primary announce position. This position shall allow for announcements over the bowl PA as well as mixing of multiple audio sources into the PA system. Provide a minimum of a 12-input channels mixing console.

E. Various quantities and types of loudspeakers may be mounted on the underside of the center or end hung video boards. The exact layout of the loudspeakers will be dependent on the final scoreboard enclosure dimensions and elevation.

F. The bowl sound system will serve as mass emergency notification system with interfaces to the fire alarm panel, pre-recorded message repeaters, and local/remote paging. All sub-systems

and infrastructure required to operate the bowl sound system shall be compliant to local and NFPA 72 building code.

G. The bowl sound system will require amplifiers located in AMP rooms on the Catwalk of the facility. The Amp room will contain approximately 10-12 full-sized equipment rack dedicated to bowl sound systems equipment.

H. During normal function, the bowl sound system will operate on a dedicated, independent IP network. Analog tie-lines from the control room to each AMP room will serve as backup communication if the IP network fails. Network equipment, user interfaces, and routing equipment serving the bowl sound system will be connected to uninterruptible power supplies. The control room and all TR' serving the bowl sound system are supported by an emergency generator.

I. A radio-frequency based assisted listening system will tie into the bowl sound system. Audience members requiring assisted listening may check-out a necklace receiver and earpieces that tune into an audio feed specifically tailored for the hearing impaired that supplements the sound received from the bowl loudspeakers. There will be a sufficient quantity of assisted listening receivers to match local and ADA building code.

J. Portable sound systems will be able to tie into the stadium sound system through various connections on the field wall. The sound system may be programmed such that any combination of speakers or clusters is active at one time.

K. A dedicated IP audio network will be provided to comply with survivability requirements of life safety announcement systems. Contractor shall provide all network equipment, and wiring required to provide a turnkey solution. Network equipment shall be of the same type and manufacture as the base building network to allow for a common management platform at the Owner's selection.

9.3 PROGRAM REQUIREMENTS

A. The following room locations and/or area types are proposed to have audio devices as noted below to provide the requirements listed above. Additionally, all audio devices installed in exterior (or wet) conditions shall be weather-proof grade. Program below is typical. Refer to drawings for approximate equipment quantities.

Base Program Requirements:

1. Admin. Office Area Entrance: Overhead ceiling mounted speakers
2. Admin Staff Entrance: Overhead ceiling mounted speakers
3. Building Exterior Perimeter: Building mounted and overhead mounted outdoor speakers.
4. Cash Counting/Handling/Vaults: Overhead ceiling mounted speakers
5. Clubhouse Area/Entrance: Overhead ceiling mounted speakers
6. Concession Stand: Building mounted speakers for outdoor concessions and ceiling mounted for indoor concourses integrated with Seating Bowl Sound System.
7. Concourses: Combinations of overhead, wall and structure mounted speakers integrated with Seating Bowl Sound System.
8. Corridor: Overhead ceiling mounted speakers, or pendant speakers mounted from structure.
9. Elevator Cab: Cab audio interface for TV display or overhead speaker as required.
10. Elevator Lobby: Overhead ceiling mounted speakers, or pendant speakers mounted from structure.
11. Entrance Portals: Speakers mounted to canopy structure.
12. Event Staff Entrance: Overhead ceiling mounted speakers
13. Lobby Overhead ceiling mounted speakers

14. Locker Room Area: Overhead system, interface to room AV system.
15. Multipurpose\Green\Interview Room: Overhead audio with local override coordinated with local AV system.
16. Novelty Stands: Overhead ceiling mounted speakers, or pendant speakers mounted from structure.
17. Plaza Area (Exterior): Provide additional system outputs and zones for plaza audio, to be confirmed at a later date.
18. Press Areas: Overhead ceiling mounted speakers
19. Production Studio: (2) Studio grade Monitors
20. Retail Team Store Overhead ceiling mounted speakers, or pendant speakers mounted from structure.
21. Receptionist Desks: Overhead ceiling mounted speakers with local volume override.
22. Restrooms (Public Concourses): Combinations of overhead, wall and structure mounted speakers integrated with Seating Bowl Sound System.
23. Seating Bowl: Refer to Seating Bowl requirements.
24. Suite: Overhead ceiling mounted speakers, or rear facing sound bar with local volume override.
25. Ticket Window: Overhead ceiling mounted speakers with local volume override and coordinated with local AV system override for announcements.
26. TV/Radio Broadcast Booth: (2) Studio grade Monitor
27. Video Control Room: (3) Studio grade Monitors

PART 10 - DISTRIBUTED VIDEO SYSTEM

10.1 GENERAL

A. Provide a complete distributed television system using IPTV technology.

B. IPTV system shall include head-end, 1080i HDMI media players (or higher), graphics/signage package, and production computers.

C. Cat6A data cables shall be provided at each television and video display location as part of Telecommunications Infrastructure package.

D. IPTV system shall have a complete video content software package and capability for allowing customized development of wrappers, tickers, and signage.

E. The IPTV system shall fully support television, digital menu boards, digital signage, and advertising from a common platform.

F. Software shall also allow for production setup for staging and scheduling content as well as accounting time the content is displayed on specific displays or groups of displays to allow for billing of advertising content back to advertising clients.

10.2 EQUIPMENT AND COMPONENTS

A. Content Ingest
1. QAM Gateway: Provide for a centralized QAM channel server to ingest multiple feeds from cable TV service provider as needed. Provide options for 20 to 40 channels of content.
2. Satellite Tuner: Provide for an independent encoder for (2) satellite tuners.

3. Local Content: Provide for encoders to receive 4K quality feeds from the National TV truck and the in-house production workflow to allow display of locally produced content through IPTV system.

B. Network
IP Network to be provided by Network scope of work. Coordinate all requirements and needs with Network provider.

C. Servers and Workstations
1. Provided for all required workstations to manage solution for up to two users. At the Owners option they can provide their own workstations and contractor will configure and setup local software for Owner.
2. Servers shall be provided by the contractor as recommended by the solution manufacture based on the number of inputs and system size. Servers shall be enterprise grade. Coordinate corporate security and anti-virus requirements with Owner prior to installation and configure as required.

10.3 PROGRAM REQUIREMENTS

A. Each TV display shall be provided with its own dedicated IPTV receiver to display content from the network.

B. Contractor shall coordinate with the network provider to advise on appropriate network configuration for each port in the network.

C. Provide IPTV receivers in each AV system rack location to allow for display of local and broadcast content on displays in those spaces. Provide an IPTV receiver for each feed needing to be shown in each AV space.

PART 11 - LARGE FORMAT VIDEO SYSTEMS AND PRODUCTION

11.1 GENERAL

A. Video board system requirements have been developed and designed in conjunction with several manufacturers for large format video displays, score boards, ribbon boards, etc.

B. Systems shall be complete and turnkey including boards, systems, infrastructure, and production/control equipment and room.

C. Contractor and Vendor shall provide Owner with multiple display resolution options with pricing for the large video boards and installed example locations for review and approval.

D. Provide for a turn-key broadcast production work space and workflow typical of an MLS venue. Contractor shall work with manufacturers, Owner and Engineer to provide for a fully functioning system based on the Owners final requirements.

11.2 EQUIPMENT AND COMPONENTS

A. In House Production Consoles and Displays
1. Video Matrix Switcher: Provide for a 16-input video switcher capable of supporting broadcast quality 4K/8K video and production workflows.

2. Consoles: Provide for production consoles to support workstations and Video Switcher. Refer to floor plans for layouts. Consoles shall include (3) Large Format screens 60-inches or larger for entire production team to see current content. Local displays shall be provided for each seated position based on the needs of each workstation.
3. Replay / Content Management Workstation: Provide for a replay and event clip management system. Shall include all recording equipment and workstations needed.
4. IPTV Workstation: Provide for a workstation to direct and control the IPTV system content.
5. Video Cameras: Provide for in-house fixed and wireless cameras
   a. Provide (2) Wireless Cameras and (4) fixed cameras for in-house production workflows.
   b. Cameras shall be of broadcast grade.

B. Video Boards
1. End Hung Triangular Video Board: Configuration shall consist of (2) locations at court/ice surface end zones with (3) boards each mounted in a triangular shape. System shall use 4-6mm pitch. Refer to architectural drawings for sizes and configurations.
2. Center Hung Video Board: Alternate to End Hugn Trianglular Boards. Configuration shall consist of either (1) location with either (2) long boards with (2) smaller end boards and (2) smaller boards installed on back side of long boards. System shall use 4-6mm pitch. Refer to architectural drawings for sizes and configurations.
3. Ribbon Boards: System shall use 16-20mm pitch and be approximately 24-inch high. Refer to architectural drawings for locations and lengths.
4. Exterior Plaza and Marquee Boards: Requirements and locations to be determined.

C. Broadcast Intercom
Provide for wiring, system, controls, and headsets for a broadcast intercom system for each position:
1. Director
2. Assistant Director
3. Spotter
4. Producer
5. Replay
6. Edit
7. Shade
8. Slow Motion
9. Scoreboard Control 1
10. Scoreboard Control 2
11. Announcer
12. Each in-house camera position.
13. Include wireless antennas, headsets and accessories as required for mobile cameras.

D. Scoring System
Provide a turn-key scoring system per NBA and NHL Venue Standards requirements.

END OF TECHNOLOGY NARRATIVE

PART 12 - TECHNICAL ABBREVIATIONS AND ACRONYMS

ACH	air changes per hour
AFF	above finished floor
ANSI	American National Standards Institute
AP	access point
ATM	Automatic Teller Machine
BICSI	Building Industry Consulting Services International ®
BTUH	British Thermal Units/Hour
^{o}C	degree Celsius
Cat.	category
CMP	communications plenum (cable rating)
CMR	Communications riser (cable rating)
CO-OSP	customer owned outside plant
DVR	digital video recorder
EIA	Electronics Industry Alliance
^{o}F	degree Fahrenheit
ft	feet
ft^2	square feet
GB	gigabyte
Gbps	gigabits per second
GHz	gigahertz
HC	horizontal cross-connect
HVAC	Heating, ventilation, air conditioning
IC	intermediate cross-connect
IEEE	Institute of Electrical and Electronics Engineers, Inc. ®
IP	Internet protocol
IT	information technology
KW	kilowatt
LAN	local area network
LCD	liquid crystal display
m	meter
m^2	square meter
MB	megabyte
Mbps	megabits per second
MC	main cross-connect
MHz	megahertz
MPOE	main point of entry
mm	millimeters
NVR	network video recorder
PBX	private branch exchange
PC	personal computer
POE	power over Ethernet
POS	point of sale
PSTN	public switched telephone network
PTZ	pan-tilt-zoom
RAID	random array of independent disks
RH	relative humidity
SP	service provider
TDM	telecommunications design methods
TGB	telecommunications ground bus
TIA	Telecommunication Industry Association
TMGB	telecommunications main ground bus
TSB	technical service bulletin
TV	television
UPS	uninterruptible power supply
V	volts
VoIP	voice over Internet protocol
WAN	wide area network
Wi-Fi	wireless fidelity
WLAN	wireless local area network
XML	Extensible Mark-Up Language