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MULTI-OPERATOR NEUTRAL HOST IBS/DAS ARCHITECTURE FOR HIGH DENSITY UNIVERSITY CAMPUS

This technical engineering deployment addresses deep indoor cellular attenuation and call drops across a multi-building academic estate. By engineering a unified Neutral Host In-Building Solution (IBS) coupled with Outdoor Distributed Antenna Systems (ODAS), the network architecture replaced weak macro-penetration. The shared infrastructure provides multi operator carrier signals across high-rise and open campus environments.

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Background

A private university in Bengaluru, Karnataka, known for its academic excellence and social commitment, was focused on building an inclusive, future-ready campus environment. As the university expanded its academic, residential, administrative, and digital service infrastructure, dependable mobile connectivity became essential to everyday campus life.

High-Density Campus Connectivity Bottlenecks

- **Vertical RF Attenuation:** Dense building materials and high-mass concrete failed to pass macro tower signals to the upper floors of a 40-storey high-rise structure.
- **Multi-Operator Infrastructure Bloat:** Traditional approaches required separate equipment rooms for each telecom operator, increasing space requirements and maintenance complexity.
- **M2M Authentication Failures:** Inconsistent data loops caused timeout errors for campus IoT services, including automated QR-code validation terminals.
- **Weak Indoor Coverage:** Weak signal strength inside buildings/enclosed areas, frequent call drops and poor voice quality
- **Inconsistent Mobile Data:** Slow, inconsistent mobile data speeds and digital connectivity gaps in hostels, common areas, and higher floors
- **Critical Communication Gaps:** Difficulty supporting emergency communication, visitor check-ins, academic coordination, and digital welfare services

Why It Matters

Reliable mobile connectivity directly influences learning continuity, student welfare, campus safety, operational efficiency, and institutional reputation. Students need mobile data to access learning platforms and digital resources; faculty and administrators for dependable communication, and visitors for OTP-based check-ins.

A key concern was the operation of QR-code-enabled sanitary pad vending machines in hostel facilities. These services require real-time mobile connectivity for QR authentication and transaction processing.

Solution Approach

iBUS Networks proposed and implemented a Neutral Host IBS/DAS solution designed to support multiple telecom operators through shared infrastructure. The solution combined indoor distributed antenna systems(DAS) for critical buildings with outdoor distributed antenna (ODAS) coverage to create a seamless campus-wide mobile experience.

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Engineering Implementation Matrix

Phase 1

RF Mapping & Zone Assessment

Walk-testing and spectral surveys to identify structural attenuation coefficients across academic dead zones.

Phase 2

Hybrid IBS/ODAS Topology

Designing a shared fibre backbone that feeds indoor antenna networks while matching open-air ODAS nodes.

Phase 3

Carrier Convergence

Aligning multi-operator wireless signals into a unified head-end interface to deliver shared infrastructure efficiency

Phase 4

Deployment and Installation

Installation of head-end equipment, optical distribution systems, fibre backbone, indoor DAS, outdoor antennas, passive RF components, and phased execution aligned with campus operations.

Phase 5

Testing, Optimisation and Commissioning

Walk testing, outdoor validation, voice/data performance checks, signal balancing, blind-spot elimination, final acceptance testing, and handover.

The Key Performance Metrics Matrix

Network Performance Parameter	Pre-Engineering Baseline	Post-Engineering Metric
• Indoor Signal Coverage Area	• 60% – 65% Attenuated Footprint	• Over 95% Omnidirectional Coverage
• Voice Call Drop Frequency	• Moderate / Frequent Drops	• High Reliability / Dropless Handovers
• Data Speed Integrity	• Inconsistent Packet Throughput	• Stable and Dependable Cellular Links
• User Network Grievances	• Elevated Volume of Complaints	• Significantly Reduced Rate
• Multi-Operator Availability	• Limited Single-Carrier Access	• Fully Enabled Shared Infrastructure
• High-Rise Vertical Limit	• Ground Floor Structural Attenuation	• 40-Storey Vertical Penetration

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Key Benefits

- **Enhanced learning experience and operational efficiency**

  Students and faculty gained reliable access to digital learning platforms, online resources, and collaboration tools. Better coordination for administrative teams, facility managers, and service providers.

- **Improved student welfare**

  QR-code-based sanitary pad vending machines could operate reliably, supporting convenience, dignity, and inclusion.

- **Better safety and emergency readiness**

  Campus security teams benefited from dependable communication across indoor and high-rise areas.

- **Future-ready infrastructure and reduced complexity**

  Set the foundation for future smart campus services with higher user density. Shared infrastructure minimised duplication, preserved campus aesthetics, and simplified long-term maintenance.