

# D2M Broadcast 5G Broadband Convergence Conclave

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White Paper

on

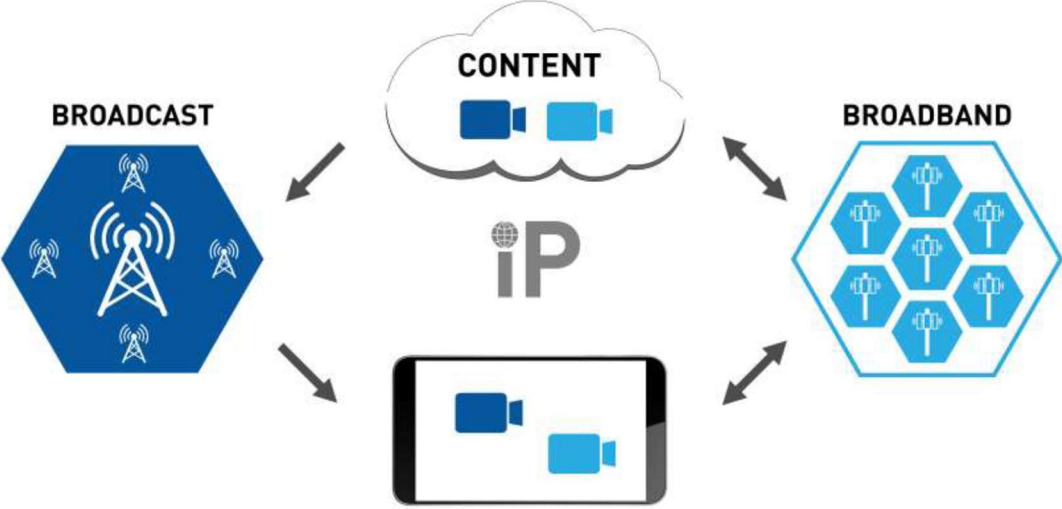
D2M Broadcast & 5G Broadband  
Convergence Roadmap for India

Summary and Recommendations

**IIT KANPUR**  
Indian Institute of Technology Kanpur



# CONVERGENCE



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## 1. Introduction

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The Conclave on “**D2M Broadcast & 5G Broadband - Convergence Roadmap for India**” is organized by Indian Institute of Technology, Kanpur (IITK). In addition to discussions and presentations, IITK officially announces a Proof-of-Concept (PoC) for NextGen Direct-to-Mobile (D2M) Broadcasting along with emerging 5G standards.

In 2021, India had 1.2 billion mobile subscribers of which about 750 million were Smartphone users. The number of Smartphone users is predicted to reach 1 billion users by 2026 as per Deloitte’s 2022 Global TMT (Technology, Media and Entertainment, Telecom) report. More than 80% of internet users access the internet on their mobiles. 82% of Internet traffic is video traffic, with 1.1 million minutes of video streamed or downloaded every second, an estimated 240.2 EB of data per month. Live Internet video traffic has increased more than the predicted 15-fold between 2017 and 2022. The consumption of video (health, educational, etc.) has only increased due to the pandemic.

With an ever-expanding Smartphone base coupled with explosive growth in Video consumption, the wireless content delivery infrastructure in India is always challenged to satisfy the demand. Traditional terrestrial Broadcast or Unicast networks cannot deliver the growing volume of video content in a cost-effective manner. Increasing consumption of audio content over internet through App based listening will render traditional proprietary radio infrastructures redundant. Further the increasing consumption of media on smartphones and smart devices over the internet necessitates mandatory provisions for public media content of strategic and national interest analogous to the mandatory carriage provisions on cable and satellite for the public broadcaster’s content.

To address some of these challenges, newer technologies which are based on the Internet Protocol, have been developed to enable convergence of broadcast & unicast infrastructure for cost effective delivery of content. The converged network is a game changer as it enables broadcast to Smartphones, Television and Set-Top-Boxes with a unified broadcast infrastructure.

## 2. Rationale

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As the largest open market for digital video content and Smartphone users, India’s challenges are very unique and more intense as compared to the rest of the world, e.g. Network Congestion, Increasing costs of Mobile Internet, spectrum allocated to the mobile network operators, etc. Hence India will benefit immensely from an indigenously developed converged broadcast–broadband network, paving the way for an “आत्मनिर्भर भारत” as envisioned by Prime Minister Narendra Modi.

India will also establish itself as a global leader in convergence between Broadcast & Broadband technologies while it seeks to develop indigenous standards for 5G, 6G and beyond.

### 3. Benefits

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#### Consumer Perspective

The Converged Direct-To-Mobile (D2M) network will enable the end User to access unlimited video (Educational or Entertainment) & data content at a nominal fixed monthly price without having to rely on costly & often unreliable mobile broadband networks.

The Direct-To-Mobile Next Generation converged broadcast-broadband network enhances the Instantaneous speeds & consumer experience by delivering the same superior quality to all users, regardless of the number of users consuming the content.

#### Telecom Operators' Perspective

One of the main use cases of the D2M network is its ability to converge with traditional mobile networks and provide additional data pipe to the mobile operators, which can potentially help decongest the network from heavy bandwidth consuming applications such as Video, OTT etc.

#### Broadcaster's Perspective

For the broadcaster it will increase its customer reach and enhance the ability to monetize the available spectrum since anyone with IP content can plug into the Converged D2M platform.

Once a Direct-To-Mobile network is rolled out, Broadcaster can use such a network as data pipe and deliver various applications apart from traditional TV, such as educational content, emergency alert system, Video on demand, FOTA (firmware upgrade over the air for automobiles), etc.

It also enables the broadcaster to gather user statistics for targeted advertisements.

The NextGen Broadcast network is highly scalable to reach the remotest locations in India and maximize cost efficiencies with better resource utilization and spectrum management.

#### Strategic and National Perspective

With the increasing consumption of audio-video media over the internet, the dissemination of fake news and viral content has posed a wide variety of challenges to governments at all levels. Recently during the COVID-19 lockdown, crises of national significance and other incidents of natural disasters the nation has witnessed importance of Broadcast Media and the unreliability & bias of the Internet Media.

The ability to broadcast directly to millions of smart devices and smart phones will be an imperative strategic capability for Indian National Interest to ensure -

- Emergency Alerts are delivered directly, reliably and without dependence on internet/cellular networks.
- Disaster Management audio content is delivered directly and authentically in a targeted manner.
- A terrestrial fallback is available for broadcast of public content of strategic/national importance in the event of catastrophic satellite failures.

- Valuable spectrum, land, manpower and other public resources are conserved by converging Radio services to a common shared broadcast infrastructure where both audio and video broadcasts can be received through a single interface on smartphones/smart devices.
- Public Broadcasting by Doordarshan and All India Radio continues to be mandatorily accessible by plurality of citizens as they switch away from traditional cable/satellite based broadcasting to smartphone/smart device based broadcasting.

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#### 4. Proof Of Concept

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This PoC is part of Prasar Bharati's MoU activities with IIT Kanpur to establish a road map for

- Development of a near-term technology roadmap for D2M (Direct-to-Mobile) architecture, broadcasting both the linear and non-linear content for Educational, Emergency Response & OTT Use Cases, directly to the mobile devices, as an alternative to the traditional unicast, as well as traditional broadcast delivery.
  - Upgradation of existing Prasar Bharati DTT platforms with NextGen technology.
- Presentation of a comprehensive long-term technology roadmap to converge the DTT and 5th Generation Mobile Communication Technology (5G).
- Identification of new revenue streams for the Public Broadcaster to leverage the above convergence.
- Recommendation for adoption by TSDSI of the latest D2M standards and optimization of India-specific profiles.
- Submission of these profiles and standards to 3GPP in future releases.
- Adoption of an indigenous technology in support of "आत्मनिर्भर भारत".

The Proof-of-Concept is being undertaken by IIT Kanpur. For hardware purposes, IIT Kanpur has partnered with Saankhya Labs ([www.saankhyalabs.com](http://www.saankhyalabs.com)) using its Software-Defined Radio (SDR) NextGen P3 chip, incorporated into Broadcast Radio Heads (BRH), a reference smartphone, a USB dongle, and a Wi-Fi gateway.

A 3-site live PoC using low power BRHs on cell towers has been established in Bengaluru to test the same.

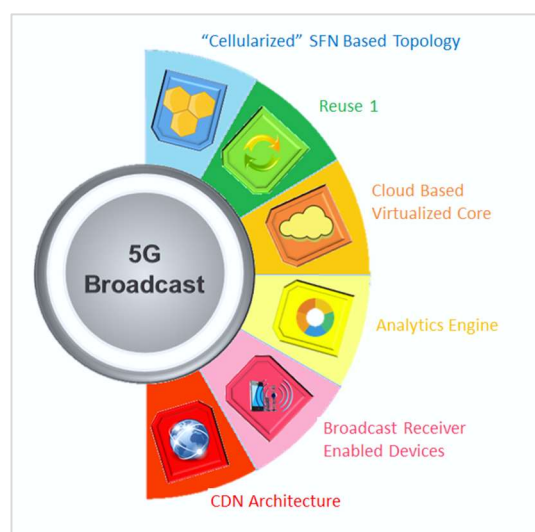
## 5. Evolution of NextGen Broadcast to 5G Broadcast

A NexGen Broadcast (NGB) architecture is a confluence of multiple new technologies that can bring maximum value to the Public Broadcaster. As an example, ATSC3.0-based NGB is an IP-based standard that can be converged with 4G/5G Core Networks.

In keeping with the direction taken by the 5G mobile network architecture, the broadcasting transmit architecture should have the following characteristics:

- Network Densification
- Cloud-native Environment
- Usage of IP transport
- Analytics Driven

An NGB can be viewed as an extension to the content delivery networks (CDNs), which allows seamless integration into the OTT ecosystem and architecture. A pictorial representation of the various legs of such an NGB is provided below.



An NGB visualizes Broadcast as a Service, which leads us to the concept of “network slice” in the converged 5G mobile networks. 5G networks are expected to provide a whole range of services, such as:

- Linear TV – Live News, e.g. News & Sports
- OTT and non-linear TV – Over The Top Content Players, e.g. Hotstar, Amazon Prime, Netflix, Sony Liv, etc...
- Hyper-local broadcasting – Localised News, advertisements, etc...
- IoT and Broadcast of Things – Internet of Things & Broadcast of Things
- Education
- Media offload for telecom networks
- Firmware downloads for autonomous cars and other enterprise applications

## Hybrid Transmit Network Architecture

As part of the transition from analog to D2M, it is imperative that newer and more efficient transmission technologies, platforms and architectures are explored.

The traditional single HPHT tower with linear video distribution is inefficient and expensive on spectrum resources because,

- 1) The same frequencies cannot be reused in adjacent areas
- 2) The low signal level supports a very small bandwidth capacity to mobiles.

Multiple technical and policy studies have reached the same conclusion that DTT should be aligned with the cellular architecture. Traditional linear broadcasting architectures use a high-power TV tower that emits about 60KW of power. This architecture assumes a roof-top 5-10 ft Yagi antenna for uniform coverage. For mobile devices, this architecture suffers from spotty coverage and lower throughputs.

More recent studies <sup>[1]</sup>, have concluded that a hybrid transmission network with a combination of High Power High Tower and Low Power Low Tower with accurate RF planning is very well suited for a Public Broadcaster for improved outdoor as well as indoor coverage.

Dense single frequency networking (SFN) is one of key innovations brought about by the NGB. Compared to HPHT, dense SFN architecture uses much lower power transmitters and provides excellent indoor signal coverage (50-100W transmitters can provide signal-to-noise ratio >15 dB). Content & advertising can be distributed over a cluster of broadcast cells or localized to a single cell. It is to be noted that mobile and fixed TV viewing can be simultaneously supported by such a hybrid network.

## Business Insights

An NGB can be viewed as a new Content Delivery Network (CDN) which aims at the convergence of broadcast and broadband networks. The Next Generation Architecture should:

- Increase viewership through ubiquitous coverage both in urban and rural India
- Increase advertising revenues through better monitoring of viewing patterns and demographics
- Allow for personalization of content and targeted advertisements to improve revenues for both broadcasters and advertisers
- Provide local news and content, which can be localised all the way down to a specific IP address.
- Optimized for India specific market dynamics. – e.g., for mobile rather than fixed network consumption.



## **6. Policy Support Requirements**

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### **1. Spectrum and Licensing Requirements**

526 - 582 MHz should be reserved for Direct to Mobile Broadcasting with related licensing provisions to enable the Public Broadcaster to rollout and operate a free to air broadcast service platform similar to DD FreeDish DTH through which both public and private audio-video-data broadcast services may be delivered to compatible smart devices/smartphones .

### **2. PPP Model for Network Rollout & O&M**

The proposed D2M Free to Air Broadcast Service Platform may be enabled to operate through a Public Private Partnership model to be financially self-sustaining with infrastructure sharing co-location with 4g/5g cellular operators in a manner analogous to how DD FreeDish DTH is being operated.

### **3. USOF Funds**

Since rural roll outs initially would be as a non-commercial public service, an allocation from USOF for the roll out of these networks and devices will help kick start the ecosystem.

### **4. Public Broadcasting Mandate**

Mandatory provision for direct to mobile broadcasting of Doordarshan and All India Radio services to all compatible smart devices/smartphones analogous to mandatory carriage on traditional DTH/Cable networks.

### **5. Strategic and National Broadcasts Mandate**

Mandatory provision for local emergency alerts, regional disaster management updates and nationwide broadcasts of strategic and national importance to all compatible smart devices/smartphones .

## 7. Conclave: Summary of Recommendations

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1. A larger pilot may be commissioned in Delhi with the participation of multiple stakeholders using PB's existing High Power High Tower infrastructure and deployed in conjunction with Low Tower Broadcast Radio Heads.
2. The objective of the pilot shall be to demonstrate to all the stakeholders how the D2M Free to Air Broadcast Service Platform may operate to fulfil its public/national mandate while being financially self-sustaining.

## 8. Reference

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[1] - IEEE TRANSACTIONS ON BROADCASTING, VOL. 61, NO. 2, JUNE 2015. On the Coverage and Cost of HPHT Versus LPLT Networks for Rooftop, Portable, and Mobile Broadcast Services Delivery.



