Opportunities and Challenges in India's Growing Computing and Wireless Broadband Market

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Digital Divide

Population Density Map
(source: www.reliefweb.int)

- Second Largest Telecom Market-600 Million Cellphone subscribers
  - Only 30% subscribers from rural India
- Low Geographical Coverage
  - Only 60% of India
  - 25% of villages covered
- Very Low Broadband penetration

Challenges for ICT in India

- Affordability
  - Monthly outgo of Rs 600, about 4% households (8 Millions) can afford telecom services
  - Monthly outgo of Rs 900, the number is 2%.
  - For 50% of households to bring under telecom access, the ARPU has to be under Rs 300
- Human Capital
  - Large population semi-literate
  - Traditional interface less intuitive and more complex to use
- Language Skills
  - Multi-lingual country

Affordability in Rural

- Per capita rural GDP is Rs 10000.
  - Even less affordable in rural India.
- Cost of computer hardware is in the range of Rs 15000-20000.
  - Software cost still higher

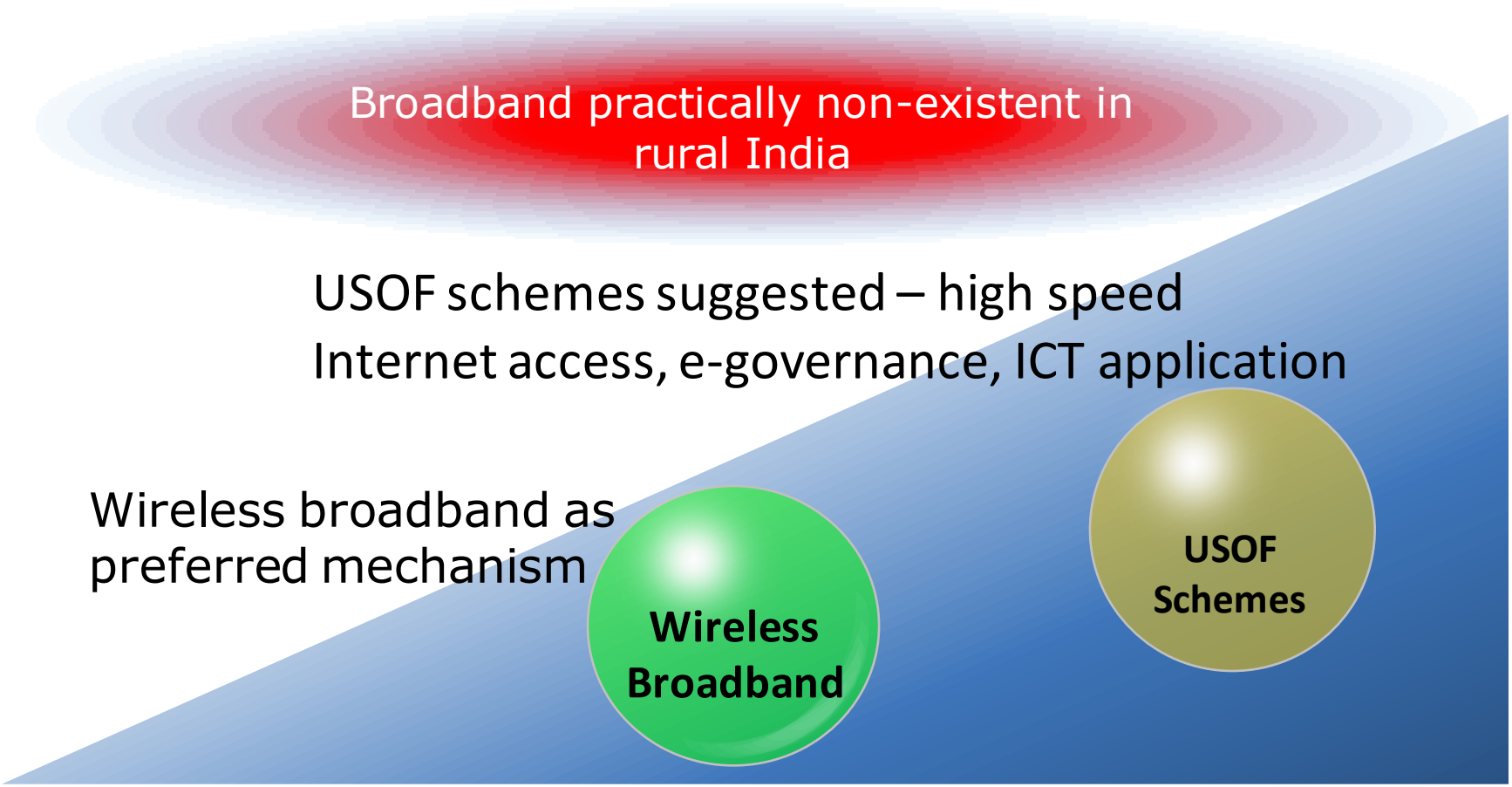
Human Capital

- Digital skills and capacity
  - General cognitive sense and skills necessary to make sense of online information
  - Basic reading and writing skills required
    - Most web information still available only in text form.
    - Need audio/video interface.
- Interface
  - Less intuitive, complex

Solutions

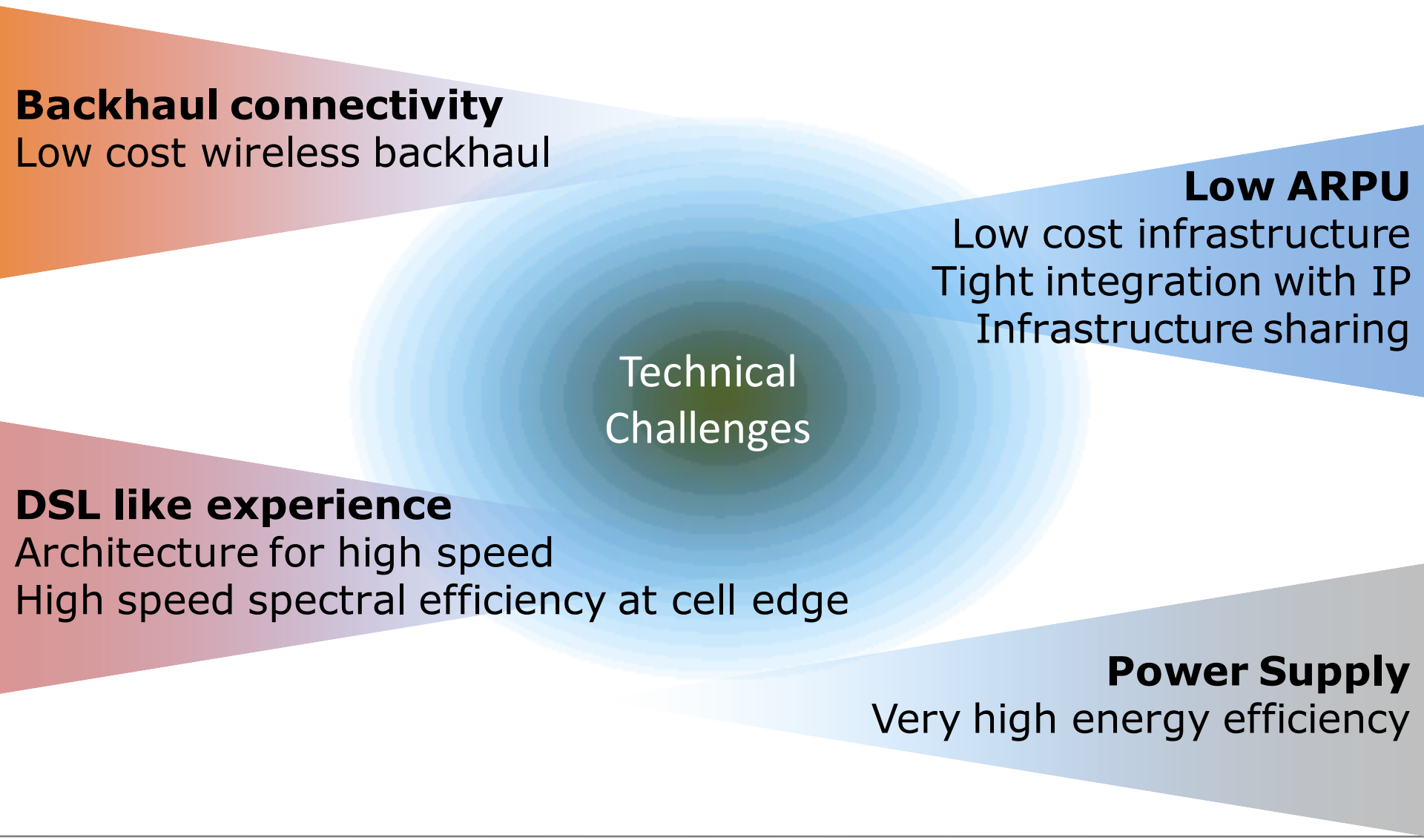
- Multilingual information access
  - Intelligent crawling, indexing, search of data
  - Automatic translation
  - Better interface
  - Handling heterogeneous data
  - Creating relevant content
- Interfaces
  - Simple and easy to use
  - More video/audio based
- Affordable Access Devices
- Affordable Connectivity Infrastructure

TRAI Recommendation: An approach to rural telephony (March2009)

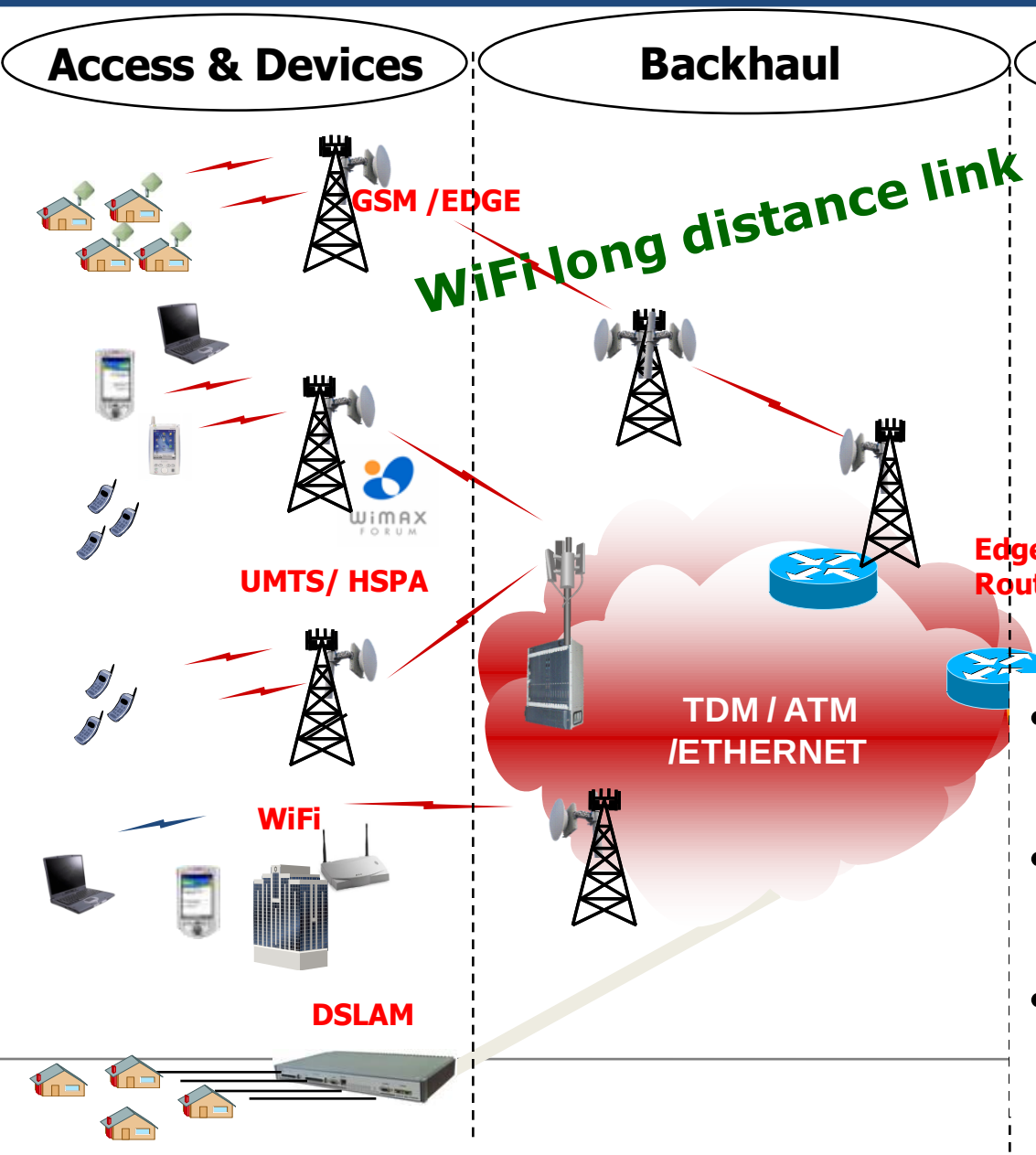


Suggested Measures for accelerated growth

Technical Challenges for Affordable Infrastructure



Backhaul



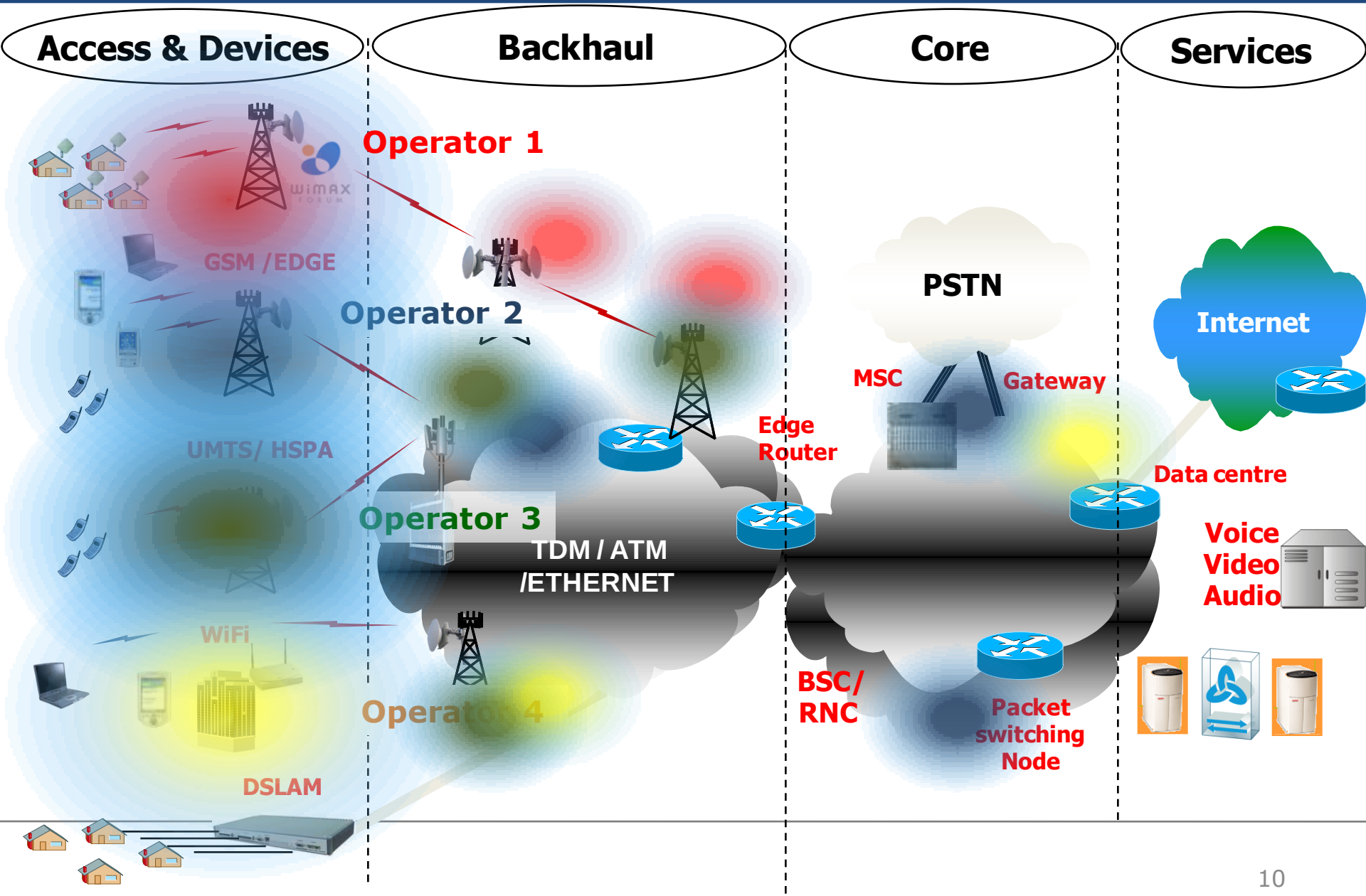
Benefits

- Inexpensive radio (<$50)
- Low power (<10 W)
- License free band
- But designed for Indoor

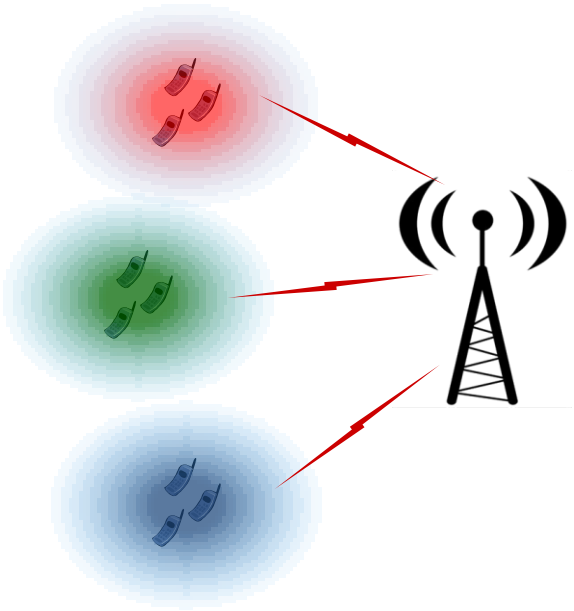
Technical Innovation

- Optimized MAC for outdoor point to point link
- Interference management for multi-hop link
- E1 circuit emulation for Legacy access GSM/CDMA)

Multi Operator Network

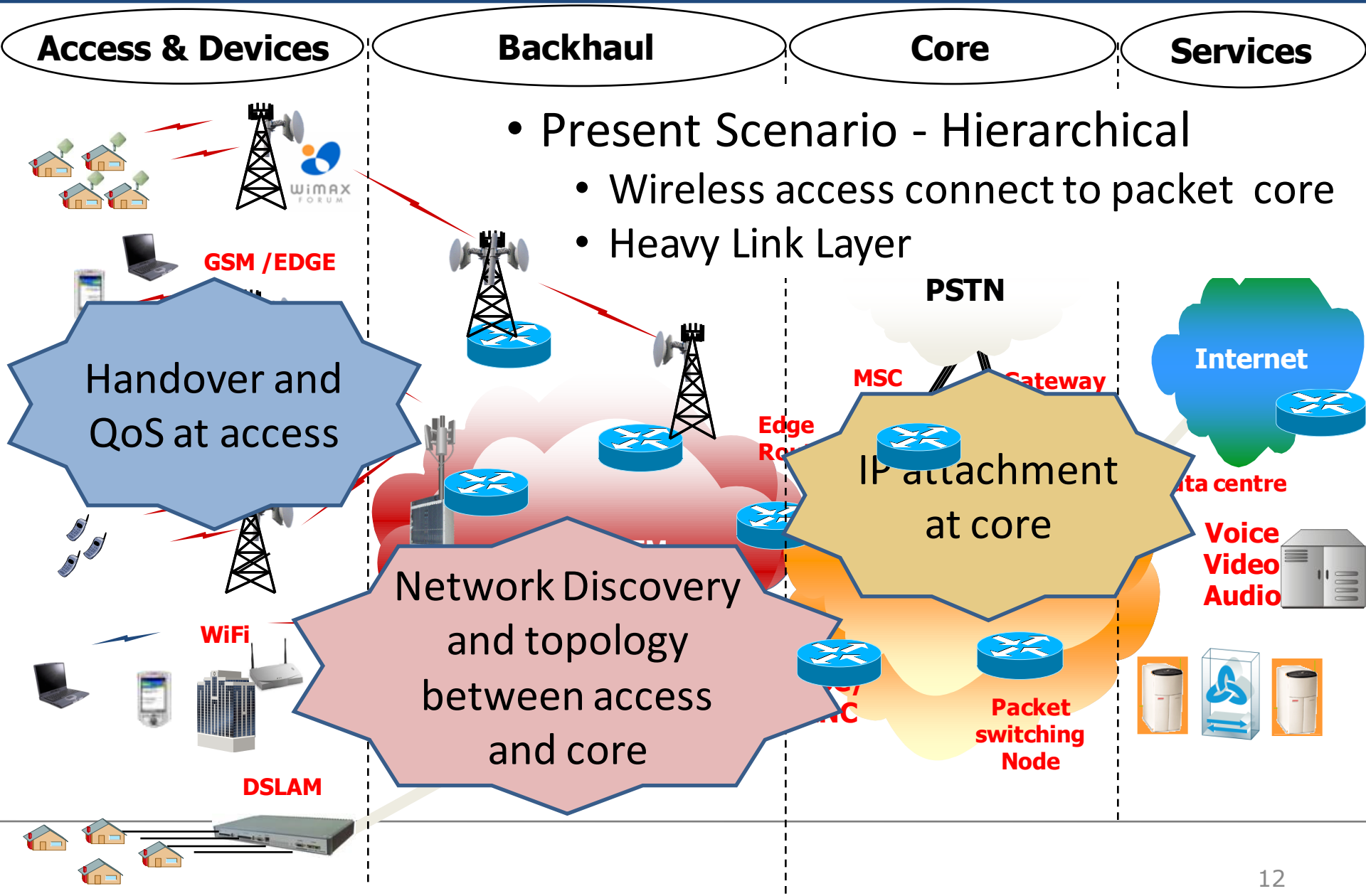


Virtual Radio Access Networks



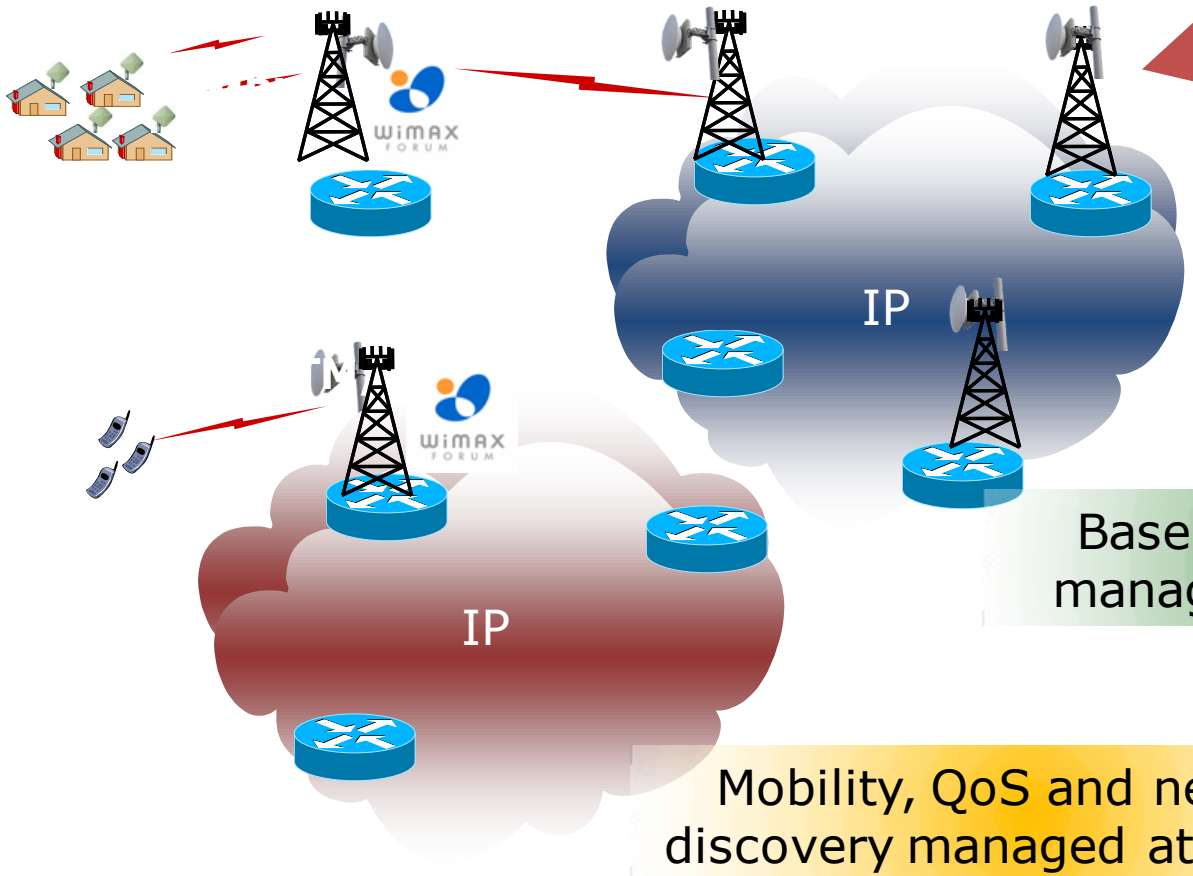
- Active Infrastructure Sharing
  - Reduce BoM for RF equipment
  - Improve energy efficiency
  - Optimize backhaul infrastructure
  - Load share ‘roaming’ between operators
- Technical Innovations
  - Intelligent switching to route and bill the user’s traffic
  - Spectrum management
  - Interference management

IP over Distributed Cellular Architecture



New Paradigm

Wireless access network as IP network of base stations



Self Configuring Distributed Architecture

Base station cooperate to manage topology discovery

Mobility, QoS and network discovery managed at IP layer

Summary

- Backhaul innovations- key to increasing rural coverage
  - FRACTEL project in TTSL-IIT Bombay Center for Excellence in Telecom
- Low cost IP based distributed architecture can bring down cost
  - On going research in IIT Bombay
- Active infrastructure sharing and energy efficient mechanisms also critical for wide spread deployment
- Innovations required in access devices
  - Low cost
  - Simple interfaces- multilingual
  - Open source software
  - Applications- eLearning, eHealth