

Telemedicine landscape of India with special reference to national strategy, trends in technology and solutions



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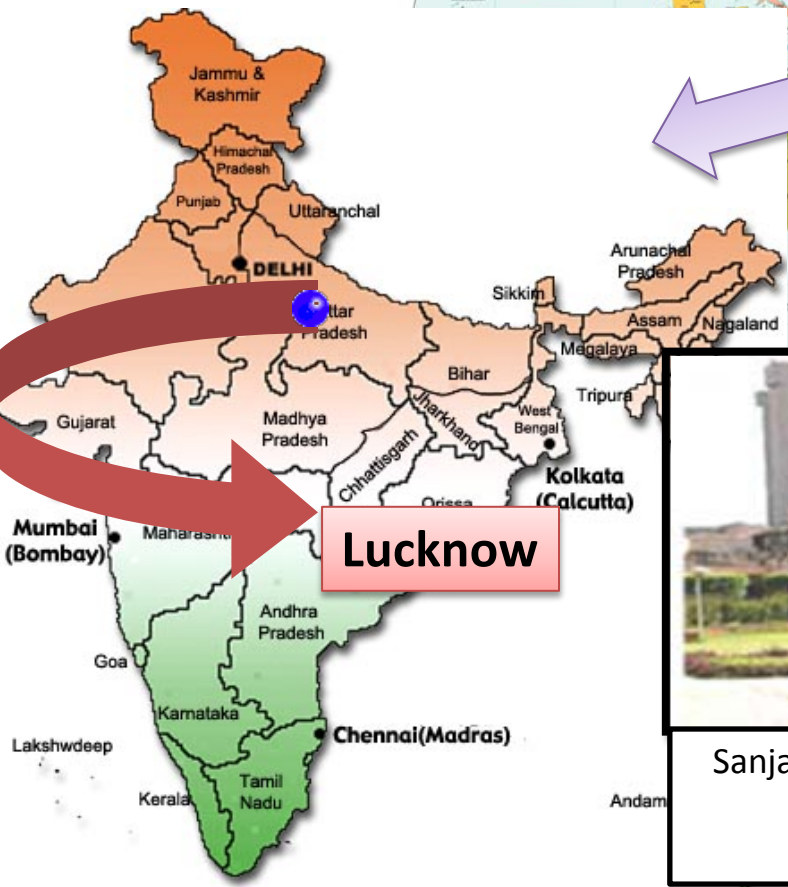
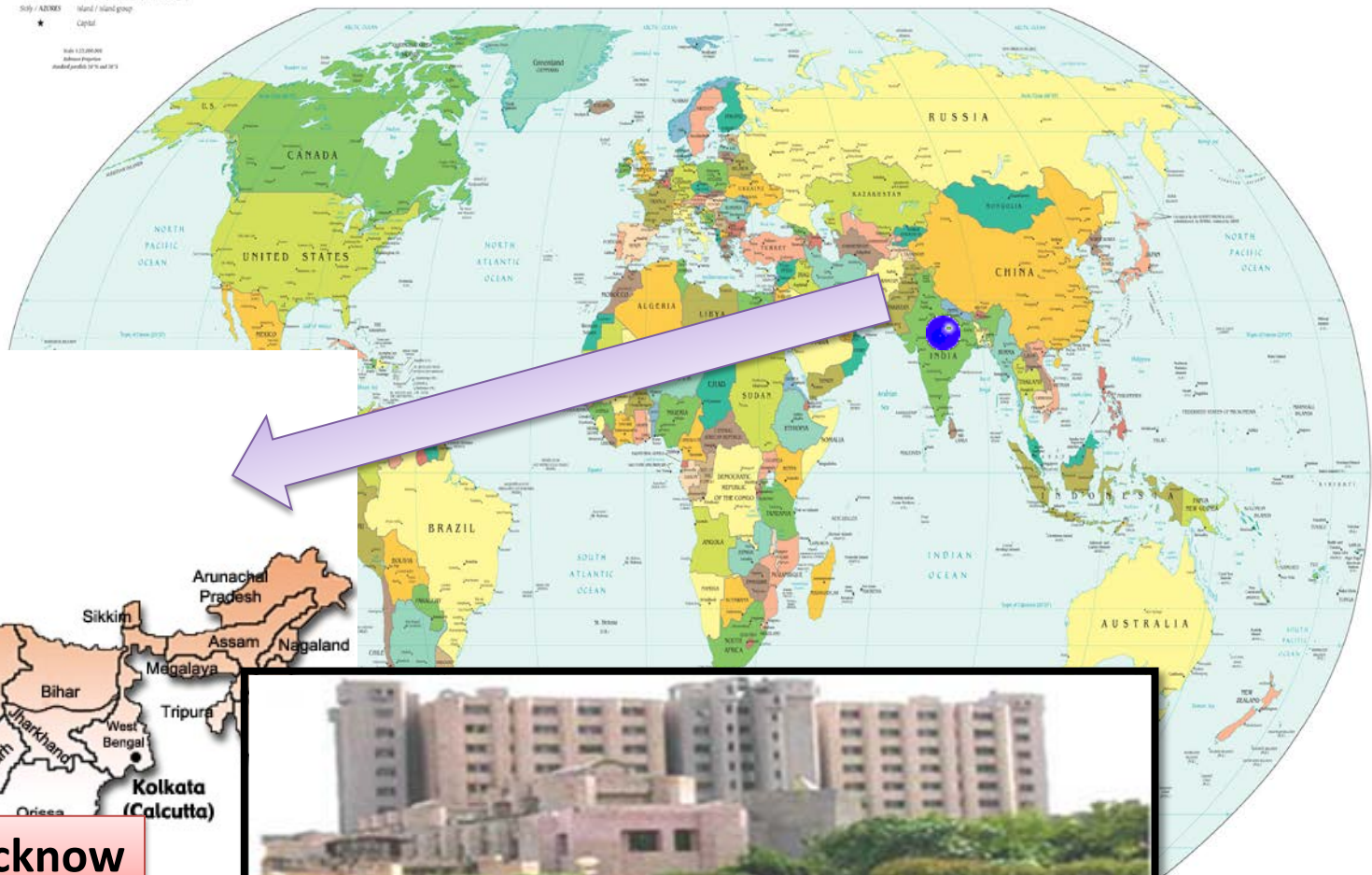
Outline

- Introduction
- Strategy of Government of India for ICT application in Health
- Brief Review of Country wide Telemedicine Programs
- Scientific activities
- m-Health in India
- New models of Rural Telemedicine
- Challenges
- Conclusions

Introduction

Legend:
Asterisk (*) denotes state
Bermuda Dependency or area of special sovereignty
Solid / Dotted line Island / island group
Star (★) Capital

Scale 1:25,000,000
Abbreviations:
Indicates location of capital



Lucknow



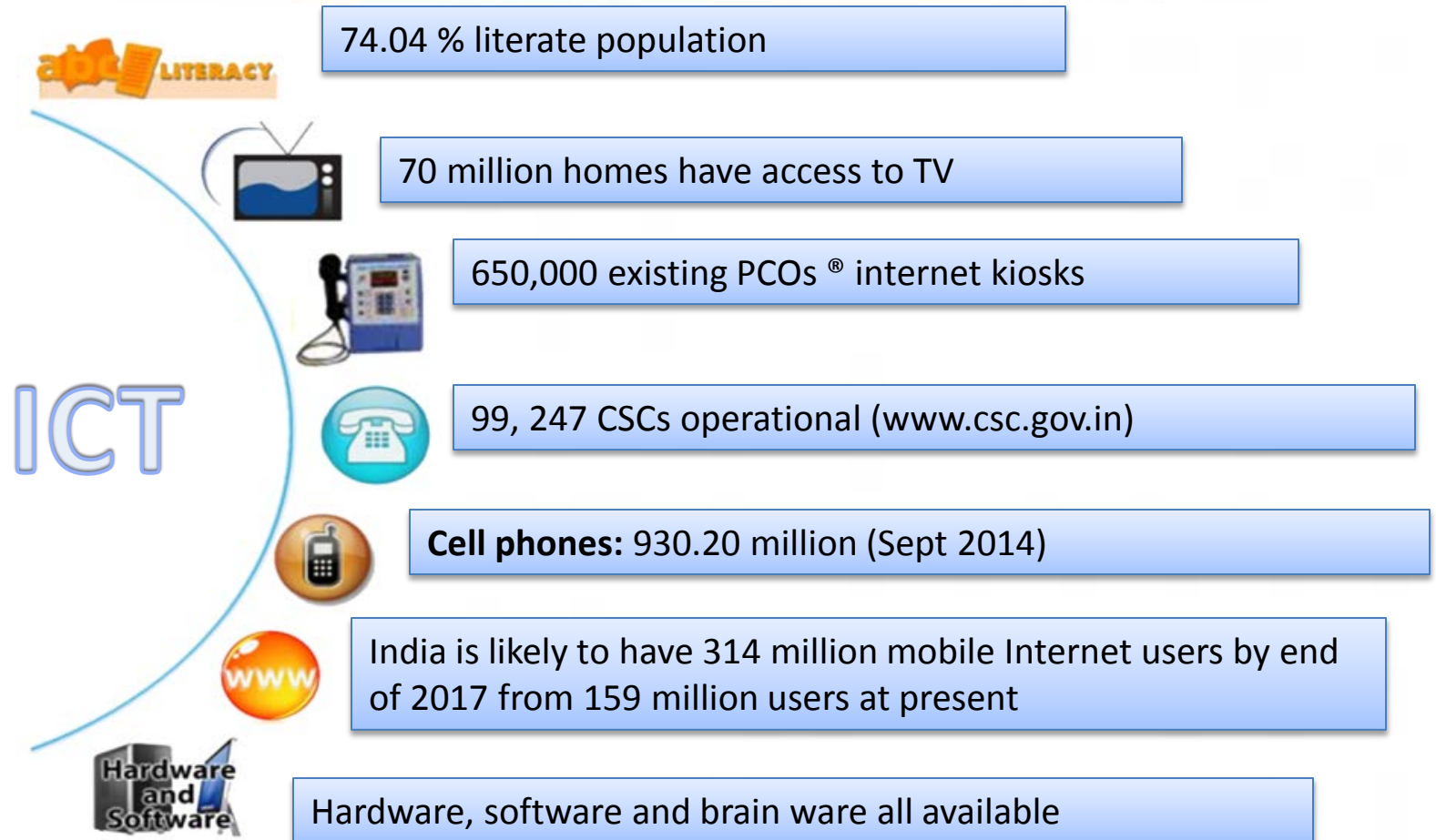
Sanjay Gandhi Post Graduate Institute of Medical Sciences
(SGPGIMS)
Tertiary Care Superspecialty Hospital

Indian Demography

- Total Area 3 Million Sq. Mtr
- 29 Provinces & 6 Union Territories
- 6,700 Km Coastal Lines
- Diverse Geography (Inaccessible hilly regions, islands, desert, coast and tribal areas)
- More than 1 billion population (70% Rural)
- Medical Experts: 70% Urban



Potential of ICT to improve Healthcare



Strategy of Government of India for ICT application in Health during during 12th Five Year Plan (2012-2017)

12th Plan (2012-2017)

- Access to CME and skill up-gradation programmes, as well as back-up support on telemedicine
- Deployment of Countrywide HIMS
- The use of ICT in health education, public health status analysis and expansion of health related research
- All District hospitals linked by telemedicine channels to leading tertiary care centres
- M-Health, the use of mobile phones to speed up transmission

http://planningcommission.nic.in/aboutus/committee/strgrp12/str_health0203.pdf

Brief Review of Country wide Telemedicine Programs

Major Implementing Agencies



Department of Information Technology
Ministry of Communications & IT
Government of India



सत्यमेव जयते

Ministry of Health and Family Welfare
Government of India



सत्यमेव जयते

MEA  INDIA

Ministry of External Affairs

Others

- State Governments
- Medical Institutions (public & corporate)

Dept of Electronics & Information Technology (DeitY) Ministry of Communication & IT, Govt. of India

- Research & Development leading to Indigenous Technology Development – Integrated Telemedicine System (platform + Software)
- Pilot deployment
- Specialty specific platform and network
 - Tele-Oncology System e.g. OncoNET Kerala
 - Tele-radiology
 - Software and system for Tropical Diseases
 - Cancer Screening and follow up using Telemedicine Bus
- Standardization activities in e-health/Telemedicine
- Prepared a framework for IT Infrastructure for Health

<http://deity.gov.in/content/medical-electronics-telemedicine-division-projects-0>

Indian Space Research Organization

Since - 2001

- ISRO has established total 382 Telemedicine Centers till date
- Super-specialty Hospitals : 73
- District hospitals-Patient end : 280
- Super-specialty + patient end: 13
- Telemedicine Mobile Vans: 16
- Operational Model: fully sponsored

www.isro.org/scripts/telemedicine.aspx



Tele-ophthalmology

- Ministry of Health & Family Welfare under National Programme on Control of Blindness

www.mohfw.nic.in/NRHM/.../NPCB_15Jan_Latest.pps

http://www.indiagovernance.gov.in/files/gkc_oneworld_tele_ophthalmology_in_tripura.pdf

- Arvind Tele-Ophthalmology

<http://www.aravind.org/telemedicine/va.htm>

- Sankarnethralaya Tele-Ophthalmology

<http://www.sankaranethralaya.org/teleophthalmology.html>



Tele-radiology

- Tele-radiology is an emerging as successful business model for telemedicine in India
- Best example of business model has been developed at Bangalore by the Teleradiology Solutions <http://www.telradsol.com/>
- Information on other Tele-radiology solution providers are
 - <http://nhtelrad247.com/>
 - www.telediagnosys.com
 - <http://www.meddiff.com/instacath.html> Mediff web based PACS / Teleradiology

Tele- Cardiology



- MTNL Delhi Telephones in cooperation with Escort Heart Institute
First Tele-Cardiology Service at Janakpuri Telemart on 17-2-2000
<http://mtnldelhi.in/customer/telemart3.htm>
- Telecardiology includes Trans-telephonic Electrocardiographic Monitoring (TTEM); Tele-echocardiography, Tele-stethoscopy.
- TTEM involves applications required to transfer ECG by Direct Electronic Transmission of wave form signal.
- **Max Healthcare pilots Telecardiology solution**
<http://computer.financialexpress.com/case-study/462-max-healthcare-pilots-telecardiology-solution>
- **Escort Health Alert System (EHAS)**
<http://heinonline.org/HOL/LandingPage?collection=journals&handle=hein.journals/ilp23&div=35&id=&page=>
- **Narayan Hrudayalaya's** worldwide 308 centers are a part of Trans Telephonic ECG network
<http://www.narayanahospitals.com/services/telemedicine/introduction/>
- **Heartcare India** <http://www.heartcareindia.com/Telemedicine/Telemedicine.Services.htm>
- **i2i TeleSolutions and Telemedicine Pvt Ltd** <http://i2itelesolutions.com>

Tele-pathology

- **Static telepathology** link was established between urban Mumbai's Tata Memorial Hospital and a rural based Nargis Dutt Memorial Cancer Hospital, from 2000 onwards

<http://www.amj.net.au/index.php?journal=AMJ&page=article&op=viewFile&path%5B%5D=855&path%5B%5D=869>

<https://tmc.gov.in/misc/aboutus.htm>

- **Tele-CPC Network**

Clinico Pathological Conference (CPC) held every Wednesday (08:00-09:00 am) held at Post Graduate Institute of Medical Education & Research, Chandigarh is transmitted simultaneously with 05 Centers across the country.

<http://pgimer.nic.in/code/telecentre/html/tele%20edu.htm>

- **Virtual pathology community** of India since 1999 <http://www.pathoindia.com/tele.html>

- **Business Model for Pathological Diagnostic Services at Home.**

Major labs have country wide network and offered web based reporting services.

National Rural Telemedicine Project under National Rural Health Mission

- Design, development and implementation of
 - Low cost rural telemedicine infrastructure
 - Village Tele-ambulance System and rural emergency healthcare services / Trauma care module
 - Rural Health Knowledge Resource through web portal and e-CME module
 - Technology platform for harvest, compilation, storage (Data Base) at Regional District Hub and Central Data Center at MOH & FW, archive and distribution across network

www.mohfw.nic.in/National%20Rural%20Telemedicine%20Network%20for%20India-...

Telemedicine Programmes at Major Academic Medical Institutions

- Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh

www.sgpgi-telemedicine.org, www.nrct.in, www.stbmi.ac.in

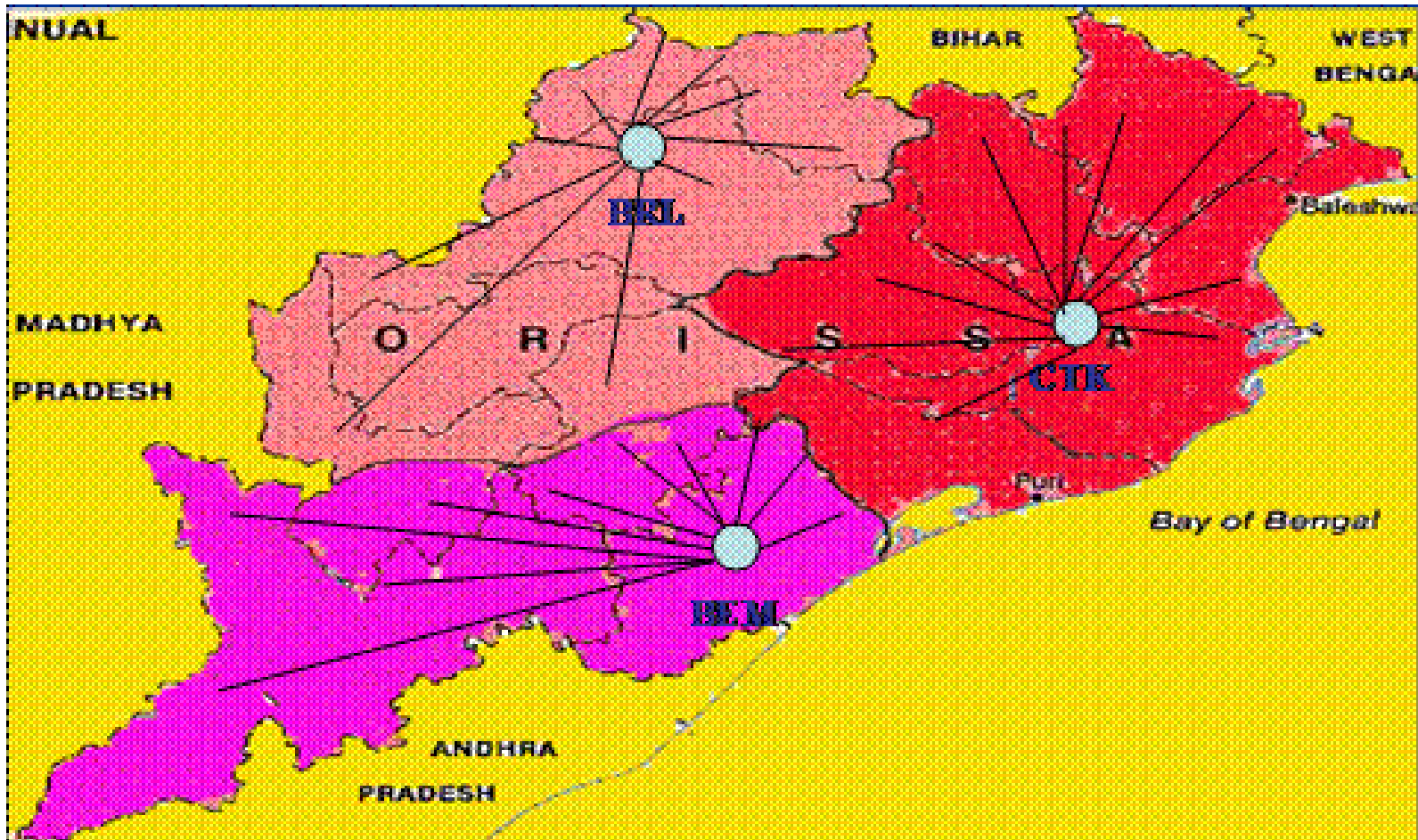
- All India Institute of Medical Sciences, New Delhi
<http://www.aiims.edu/aiims/telemedicine/telepage.htm>
- Post Graduate Institute of Medical Education & Research, Chandigarh
<http://pgimer.nic.in/code/telecentre/html/intro.htm>
- Tata Memorial Hospital, Mumbai <https://tmc.gov.in/>
- Sri Ram Chandra Medical Centre, Chennai
<http://www.sriramachandra.edu.in/telemedicine.htm>
- Amrita Institute of Medical Sciences, Cochin
<http://www.aimshospital.org/hospital/cdh/cdh.html>
- SCB Medical College, Cuttack
http://scbmch.ac.in/index.php?option=com_content&view=article&id=153&Itemid=182

Telemedicine Programmes at Major Corporate & Not-for-Profit Hospitals

- **Apollo Hospital Group, Chennai, Hyderabad, New Delhi**
http://www.apollohospitals.com/initiatives_tele.php
- **Narayana Hrudayalaya, Bangalore**
<http://www.narayanahospitals.com/services/telemedicine/introduction/>
- **Aravind Eye Hospital**
<http://www.aravind.org/telemedicine/va.htm>
- **Shankar Netralaya**
<http://www.sankaranethralaya.org/teleophthalmology.html>
- **Max Healthcare**
<http://www.cio.in/case-study/max-healthcares-telemedicine-push>
- **Fortis Escort Heart Hospital**
<http://www.fortisescorts.in/services-treatment/telemedicine-ehas>
- **CMC Vellore**
http://clin.cmcvellore.ac.in/otherwebsite/mission_support/Telemedicine.asp

State Government Initiatives under National Rural Health Mission (NRHM)

Orissa Telemedicine Network



http://scbmch.ac.in/index.php?option=com_content&view=article&id=153&Itemid=182

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NRHM Maharashtra



Govt. of Maharashtra

HEALTHY VILLAGE, HEALTHY NATION

NATIONAL RURAL HEALTH MISSION, MAHARASHTRA STATE HEALTH SOCIETY, MAHARASHTRA



Marathi Website

NATIONAL RURAL HEALTH MISSION

HOME | ABOUT NRHM | PROGRAM COMPONENTS | NRHM PROGRAMS | INFRASTRUCTURE FACILITIES | SITE MAP | CONTACT | RIGHT TO INFORMATION

» Telemedicine Project

Telemedicine is a rapidly developing application networks for the purpose of consulting, and so Telemedicine may be as simple as two health and video-conferencing equipment to conduct was first started in Maharashtra for four di Government of India and Municipal Corporation five hospitals in state through specialists from

Health institutes included for Telemedicine P

Sr. No.	Type of node	Phase-I (2007-08)
1	Controlling node	0
2	Specialist node	1
3	Patient node	5
	Total	6

IMPROVING AVAILABILITY OF CRITICAL MANPOWER	▶
COMMUNITIZATION OF HEALTH CARE DELIVERY SYSTEM	▶
PROVISION OF IMPORTANT FACILITIES IN HEALTH INSTITUTIONS	▶
TELEMEDICINE PROJECT	
AYUSH	
TRAINING AND CAPACITY BUILDING	
STRENGTHNING OF NURSING SERVICES	
SCHOOL HEALTH PROGRAM	
SERVICES FOR TRIBAL AND LEFTIST EXTREMISM AFFECTED AREAS	▶
PLANNING, MONITORING AND EVALUATION	▶
IEC ACTIVITIES	
INNOVATIVE SCHEMES	▶
MANAGEMENT STRUCTURE	▶
RCH	▶
PCPNDT	
MMU & EMS	▶

Telephone, the Internet or other
x as using satellite technology
nt places. Telemedicine project
(ISRO), Department of Space,
rovide telemedicine services to

All the Controlling and speciality nodes (6) are situated in Medical Colleges as follows and 27 patient nodes out of 23 are District Hospitals, 4 are Sub District Hospital and New 30 Sub District Hospitals.

All 6 speciality nodes

(1) K.E.M. Hospital Mumbai,

(2) Sir J.J. Hospital Mumbai.

www.nrhm.maharashtra.gov.in/nursingschool.htm

<http://www.nrhm.maharashtra.gov.in/telemed.htm>

Kerala Telemedicine Network

S.No	Projects	Number of Hospitals
1	Onconet - Cancer Care For Rural Masses	06
2	Telemedicine Kerala for Taluk hospitals	08
3	Telehealth and Medical Education Kerala	18
4	Rural Telemedicine Project for primary care in Tirur taluk	11

<http://ehealthkerala.com/MedicalInformatics/nrhm.jsp>

Floating hospital, constructed by the state government under the National Rural Health Mission (NRHM)



<http://www.medindia.net/news/kochi-floating-hospital-godsend-to-locals-101440-1.htm>

Tripura

- First telemedicine network in Tripura between GB Pant Hospital and IGM Hospital, Agartala and five other Nodal Centers
- 2nd & 3rd Telemedicine projects on the development and application of Telemedicine for Tripura Government Hospitals sponsored by the DIT, MCIT, Gol. Implementing Agency WEBEL ECS Ltd. & IIT Kharagpur.
- National Rural Health Mission (NRHM) supports maintenance and Man Power <http://tripuranrhm.gov.in/Telemedicine.htm>
- Network for alternate medicine - AUYUSH <http://tripuranrhm.gov.in/Auyush.htm>

Uttar Pradesh

- State Medical College Network
Three Medical Colleges- Allahabad, Kanpur and Meerut connected with SGPGIMS, Lucknow – Super Specialty Hospital
- Rural Telemedicine Centers at Raibareli District Hospital & Bachrawan Community Health Center

Boat Clinic in ASSAM under NRHM



<http://healthmarketinnovations.org/sites/healthmarketinnovations.org/files/Boat%20Hospital%20PPP.pdf>

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Bihar

- State of Bihar Initiated an unique telemedicine project for delivering service in alternative medicine – Ayurveda , Yoga, Unani, Sidha & Homeopathy (AYUSH)

<http://www.thepharmatimes.in/index.php/pharma-topics/awards/255-govts-award-winning-telemedicine-project-to-go-pan-india>

<http://www.keonics.com/pdf/Keonics%20selects%20KTwo%20Tech%20for%20setting%20up%20telemedicine%20network%20in%20Bihar.pdf>

<http://ehealth.eletsonline.com/2012/11/telemedicine-project-for-bihar-soon/>

mHealth in India

Mobile Portable System



Integrated Medical Equipments

PC Interface:
USB & Bluetooth



Spirometer



Common Interface



Digital Glucometer



Blood Pressure



Wrist Clinic



SPO₂



ECG

Weighing Machine

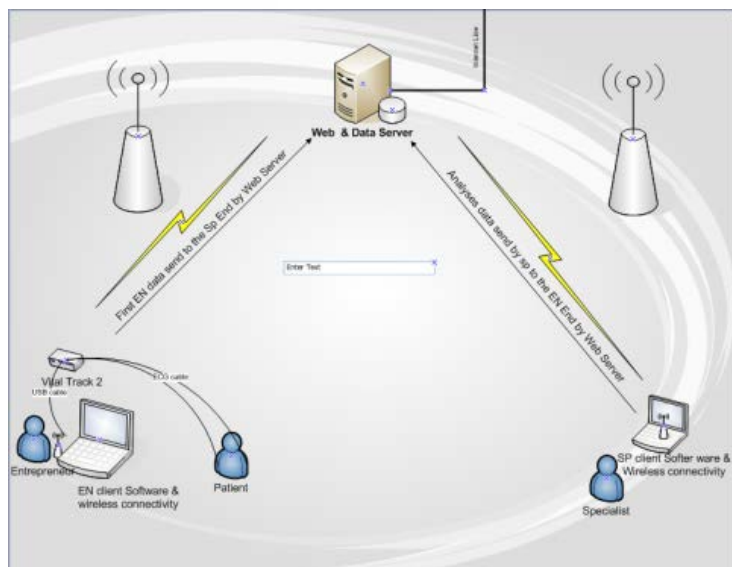


Atom based Low Cost Laptop with Integrated Telemedicine Software

Connectivity via High Speed Broadband (HSB)

Network Architecture

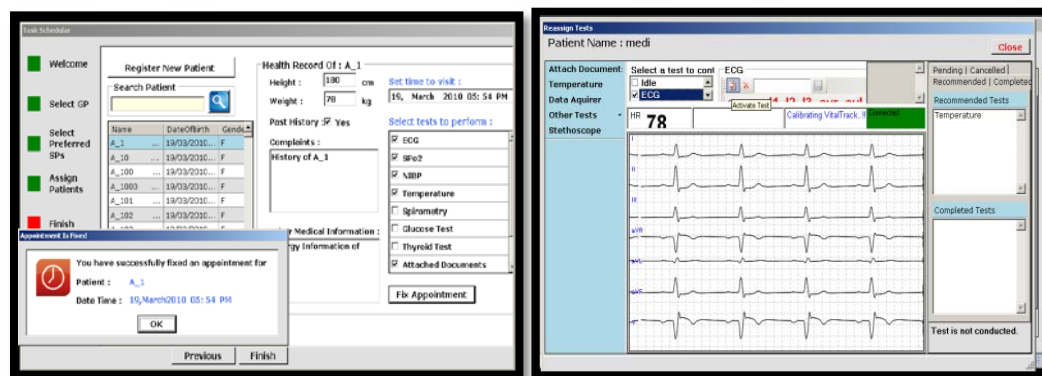
- All Software Servers are Installed at Data Center of School of Telemedicine & Biomedical Informatics



Network Architecture



Software based Video Conferencing

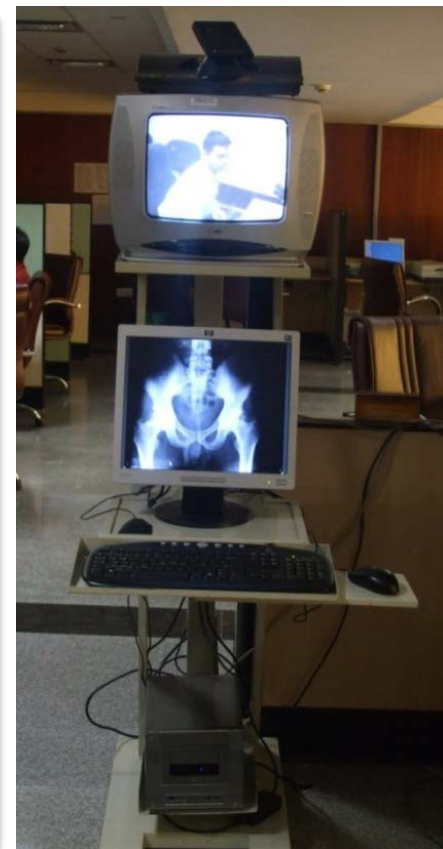


Screen Shot of Cure-Soft

Low cost portable Telemedicine Unit



Digital Operation Theatre (High Cost)



Low cost portable Telemedicine Unit

Mobile Telemedicine Kiosk Applications



Mobile kiosk @ Patient's bedside



Doctor's Duty Room



Department's Seminar Room



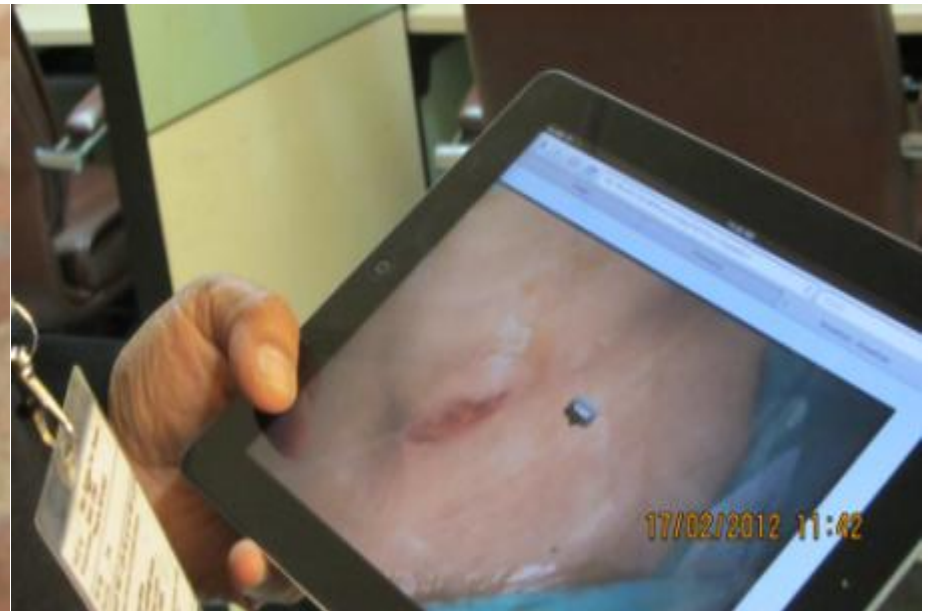
Tele-Clinic in Out Patient Department

Live streaming of surgical video



Live streaming of surgical video at doctor's workplace

Mobile Learning



World Health Partners – UP & Bihar



Telemedicine on Wheel

School of Telemedicine & Biomedical Informatics, SGPGIMS



Section I, II, III & Auning

School of Telemedicine & Biomedical Informatics, SGPGIMS



IT Section with
Video Conferencing Facility



Procedure section: Ultrasound &
Computed Radiography (CR)



Laboratory with
Video Conferencing Facility



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Green Telehealth Infrastructure

Chain of eHealth Centers in Rural and Semi Rural India



M-Health 4U



Mobile Health
Worker

+



Electric
Vehicle

= Last Mile
Healthcare
Delivery

Village eHealth Center using Solar: Concept



Mobile Health
Vehicle



Charging of Battery Operated Vehicles



One Charge takes you 60 KM

- A leading example of ICT enhanced, curriculum driven medical education particularly for under graduate programmes is Medisys Edutech (Formerly MEDRC Edutech)
- Medisys has produced over 4500 lectures, engaging several hundreds of leading faculty and edited and enhanced this repository with illustrations, animations, powerpoints etc.
- It is also bundling cases/ PBLs, ICT based CME Courses and Courses to support test preparation (FMGE, USMLE and such others)

- There are many limitations to overcome in medical education & CME in medical education such as faculty availability, time and distance, consistency of standards and right learning besides cost and universal reach.
- ICT offers interesting answers and Medisys is pioneering supplier of products and turnkey services.

Digital Approach to Medical Education: Provides On-The-Go learning facility for Students

SmarTeach[®] on Tab (UGMed)



The **smartest** way
to study Medicine.

m-Learning (Tab) Mode:

The e-Lessons are ported onto a SmarTeach tablet making the learning accessible offline on a 24x7 basis with the following benefits:

- No need for Internet: Student has all lessons “offline” in his mobile SmarTeach device. This increases accessibility and does not depend on Internet Bandwidth.
- English Language: Acts as a Revision Support for students who come from vernacular background (such as in Marathi, Telugu, Hindi, etc).
- Comprehensive & Modular Coverage: 1st professional students get Anatomy (466 units), Physiology (340 units) and Biochemistry (206 units). Subsequent subjects get added on as they progress through MBBS professional 2 and 3.
- Student controls pace of learning: Student can learn at his own pace – weaker students may view and review several times until they absorb the concept. Very useful for students coming from cultural backgrounds where English is not their first language or medium of instruction.
- Student can learn 24x7 anywhere – The lessons are accessible in the campus, at the bedside in the teaching hospital, in the hostel, at home and even in the bus on way to college and back home.
- Integrated Learning: Student can now return back and study a pre-clinical or para-clinical topic during later clinical years when what he learnt in 1st year makes more sense.
- Instant Recall: Ability to create Bookmark and jot down Quick Notes to which a student may jump back just before exams or when reviewing a case.



National Mission Mode Projects

Upcoming National Telemedicine Projects

- National Medical College Network over National Knowledge Network Fiber Backbone

<http://www.nrct.in/nmcn/>

- Rural Telemedicine Network over National Optic Fiber Network

http://iii.gov.in/index.php?option=com_content&view=article&id=397&Itemid=265

- National Cancer Network

<http://onconet.nic.in/>

- National Tele-ophthalmology Network

http://meghealth.nic.in/tenders/Teleophthalmology_guidelines_2012.pdf

National Medical College Network (NMCN)



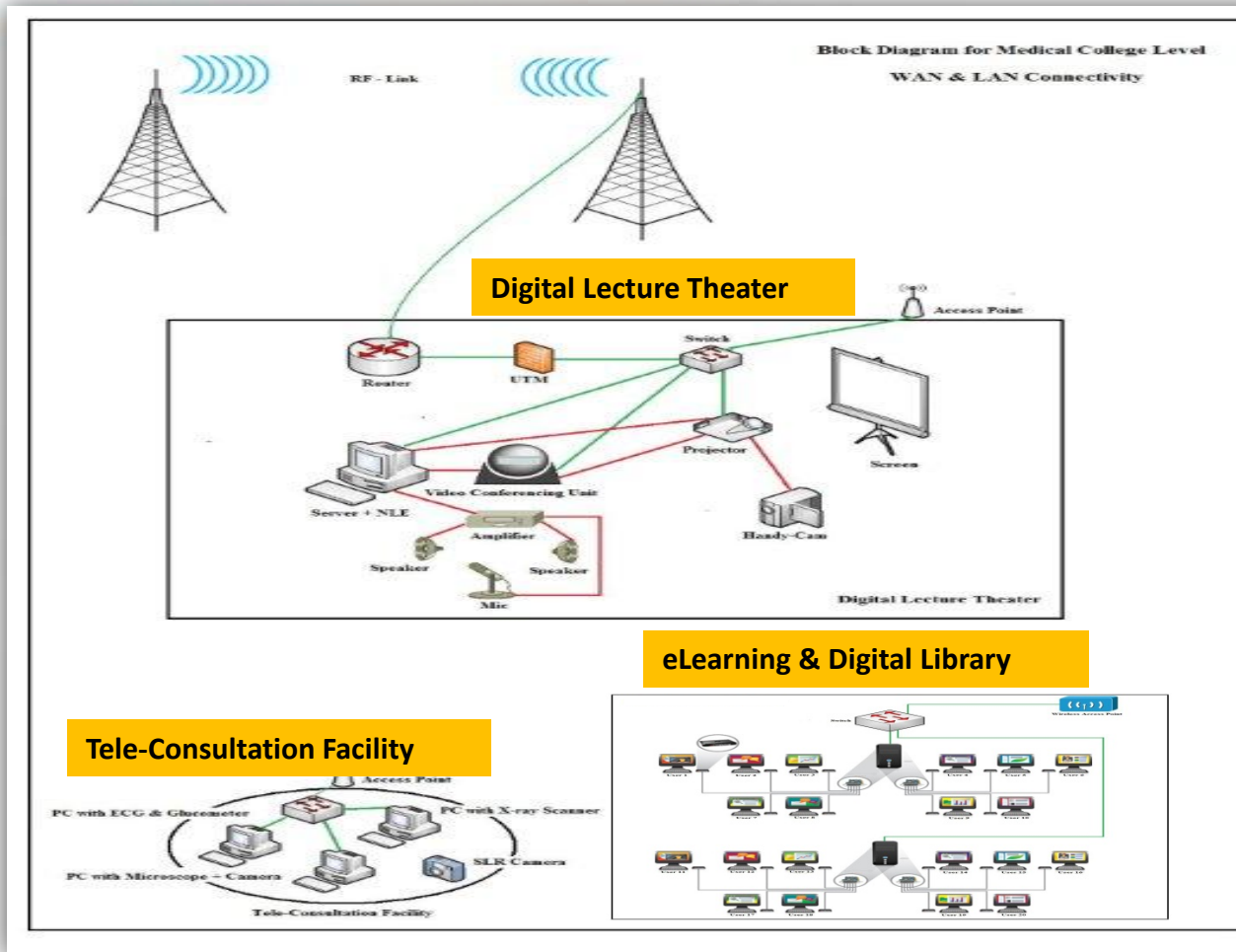
National Resource Center

06 Regional Resource Center

All govt. Medical Colleges

UP Medical College Network

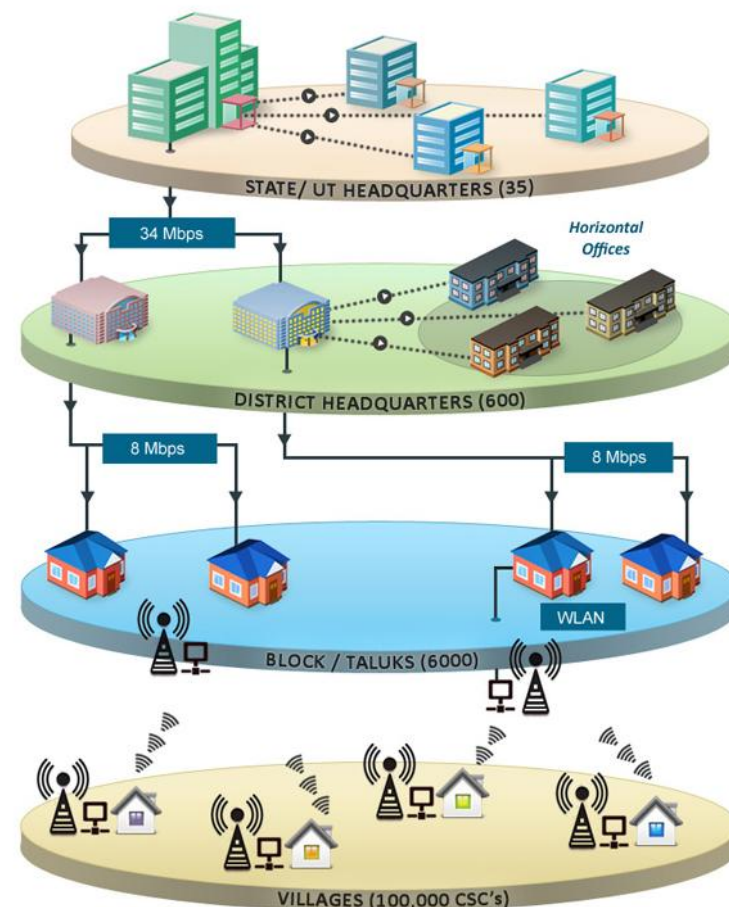
Block Diagram for Medical College Level : WAN & LAN Connectivity



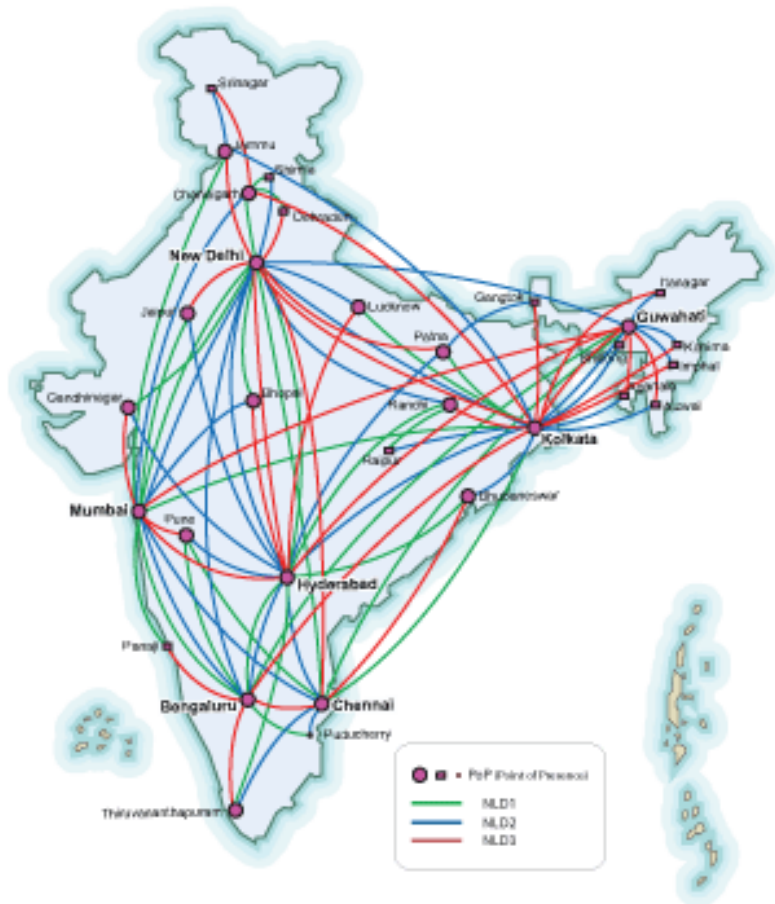
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National Telemedicine GRID

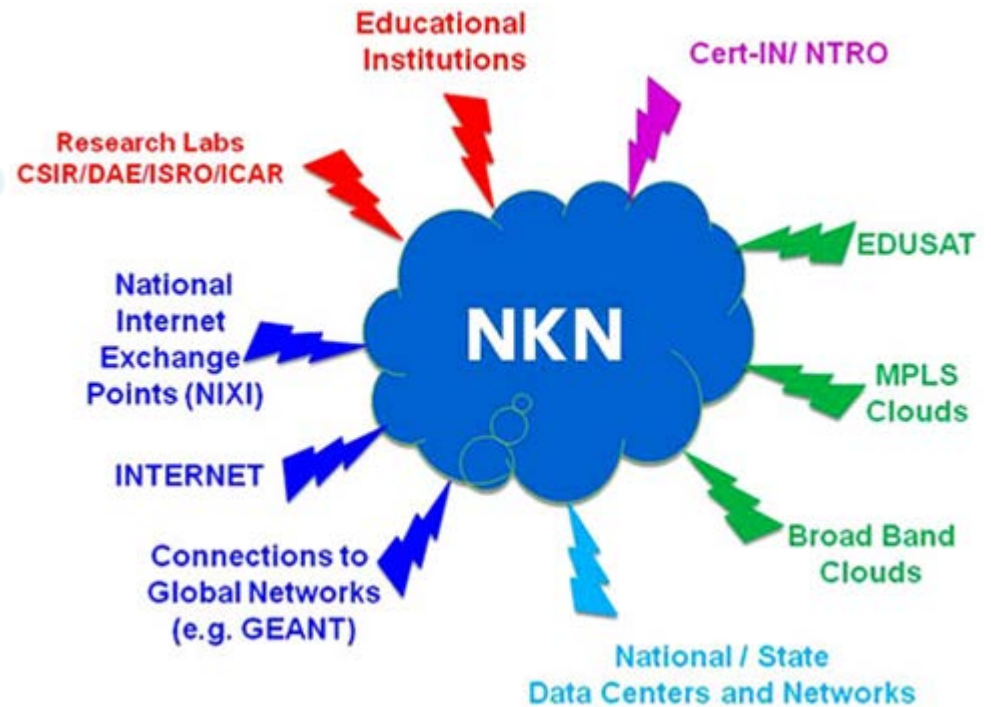
- **National Knowledge Network (NKN)**
- **National Optic Fiber Network (NOFN)**
- **State Wide Area Network (SWAN)**



NKN

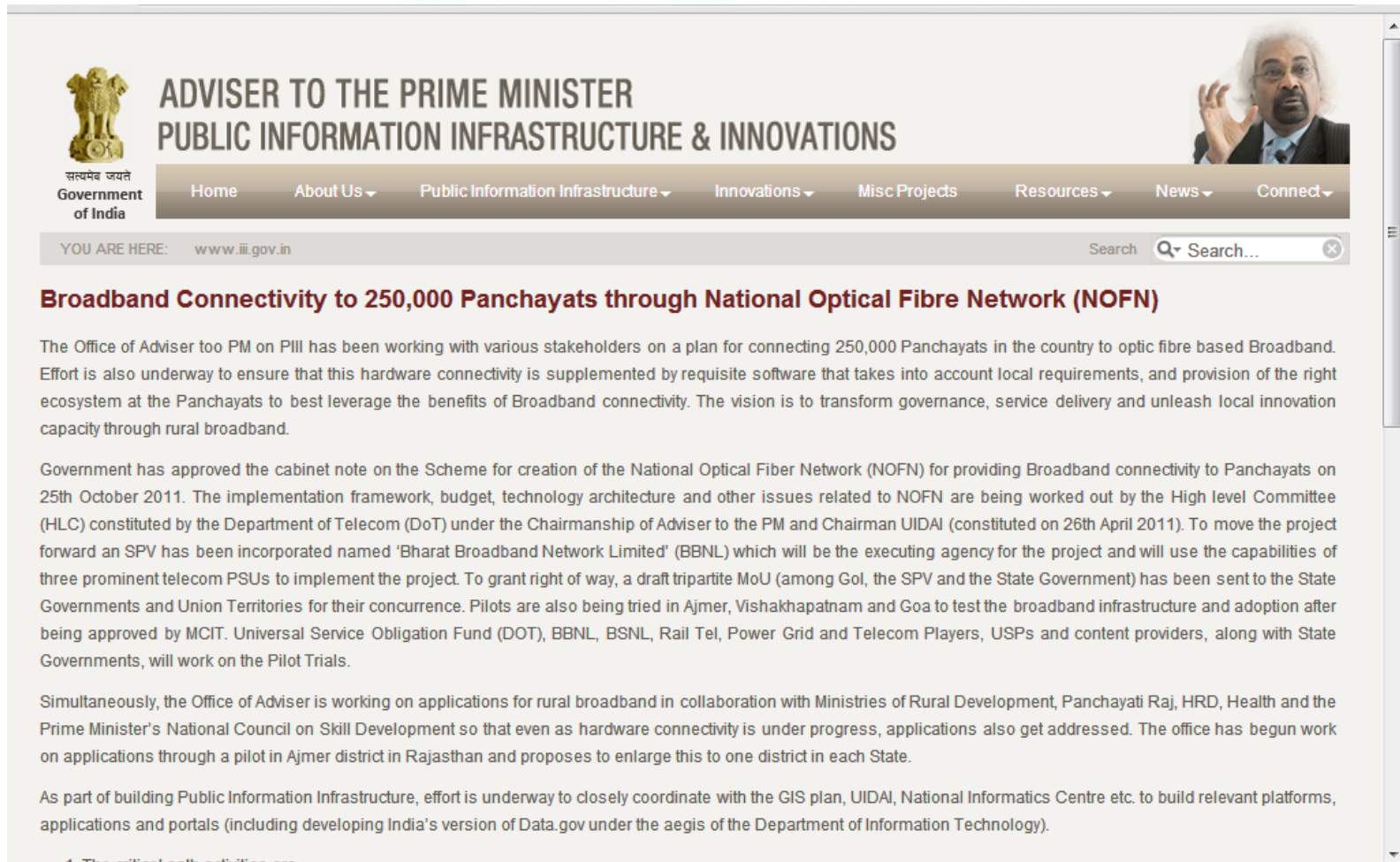



Multiple 10G Connecting all the State Capitals
Gigabit Connectivity to all the 640 Districts



<http://www.nic.in/nkn>

NOFN



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Broadband Connectivity to 250,000 Panchayats through National Optical Fibre Network (NOFN)

The Office of Adviser to PM on PII has been working with various stakeholders on a plan for connecting 250,000 Panchayats in the country to optic fibre based Broadband. Effort is also underway to ensure that this hardware connectivity is supplemented by requisite software that takes into account local requirements, and provision of the right ecosystem at the Panchayats to best leverage the benefits of Broadband connectivity. The vision is to transform governance, service delivery and unleash local innovation capacity through rural broadband.

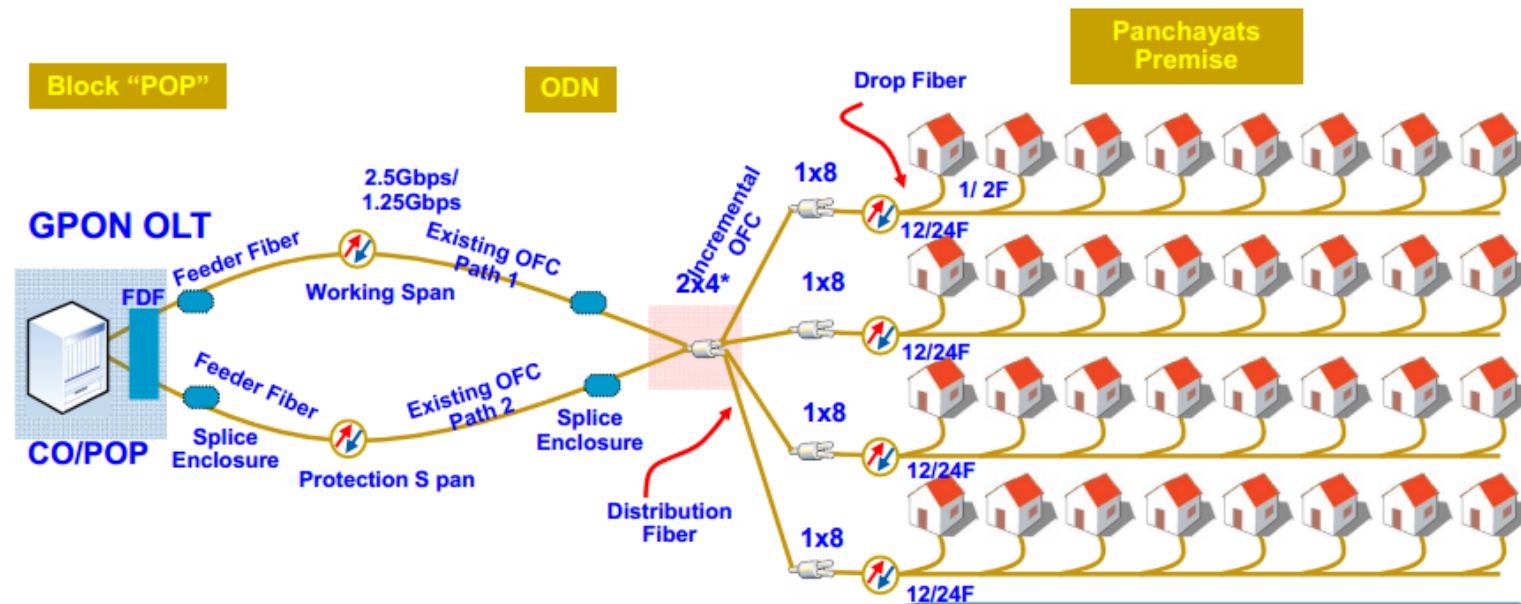
Government has approved the cabinet note on the Scheme for creation of the National Optical Fiber Network (NOFN) for providing Broadband connectivity to Panchayats on 25th October 2011. The implementation framework, budget, technology architecture and other issues related to NOFN are being worked out by the High level Committee (HLC) constituted by the Department of Telecom (DoT) under the Chairmanship of Adviser to the PM and Chairman UIDAI (constituted on 26th April 2011). To move the project forward an SPV has been incorporated named 'Bharat Broadband Network Limited' (BBNL) which will be the executing agency for the project and will use the capabilities of three prominent telecom PSUs to implement the project. To grant right of way, a draft tripartite MoU (among GoI, the SPV and the State Government) has been sent to the State Governments and Union Territories for their concurrence. Pilots are also being tried in Ajmer, Vishakhapatnam and Goa to test the broadband infrastructure and adoption after being approved by MCIT. Universal Service Obligation Fund (DOT), BBNL, BSNL, Rail Tel, Power Grid and Telecom Players, USPs and content providers, along with State Governments, will work on the Pilot Trials.

Simultaneously, the Office of Adviser is working on applications for rural broadband in collaboration with Ministries of Rural Development, Panchayati Raj, HRD, Health and the Prime Minister's National Council on Skill Development so that even as hardware connectivity is under progress, applications also get addressed. The office has begun work on applications through a pilot in Ajmer district in Rajasthan and proposes to enlarge this to one district in each State.

As part of building Public Information Infrastructure, effort is underway to closely coordinate with the GIS plan, UIDAI, National Informatics Centre etc. to build relevant platforms, applications and portals (including developing India's version of Data.gov under the aegis of the Department of Information Technology).

1. The critical path activities are

GPON Ring Branch Topology



Applications:

- High construction neighborhoods where Protection against Feeder fiber cuts is required
- High availability GPON for businesses with path and equipment protection

* Splitter located in remote CO, pole mount, Strand mount, pedestal, below grade etc

Advantages:

- Protection Up sell for business
- Protection for feeder fiber cuts
- Efficient use of distribution fiber
- Accommodates basic churn
- Few types of splitters

Disadvantages:

- May have some stranded drops
- Feeder fibers must be diversely run

Education & Training



Tele-education & Telehealth Services



Community Outreach Programme & Public Health Services




Areas Tashkent, Republic of Uzbekistan, 7-9 October 2015

Consultation



Telemedicine Deployment under PPP Model

PPP Models in Practice; Uttarakhand



The screenshot shows the website of the Uttarakhand Public Private Partnership Cell, Government of Uttarakhand. The header includes the organization's logo and name, along with a navigation menu with links for Home, GoUk, Projects, Resources, About Us, Site Map, and Contact. The breadcrumb trail indicates the current page is 'EOI : Implementation of Telemedicine in Uttarakhand' under the 'Health' category.

EOI : Implementation of Telemedicine in Uttarakhand

Department of Medical Health and Family Welfare (DoMH&FW), Government of Uttarakhand proposes to implement the Tele Medicine in Uttarakhand under PPP Mode. Expression-of-Interest (EOI) is invited from suitable company's/organizations/consortiums fulfilling the relevant pre qualification criteria for Implementation of Tele Medicine in Uttarakhand in Public Private Partnership (PPP) Mode.

Contact :
Director General, Directorate of Medical Health and Family Welfare,
Near IT Park, Danda Lakhond, Sahastradhara Road,
Dehradun, Uttarakhand.
Phone no: 0135-2608942, Fax no. 0135-2608746

NONCOMMITTAL EXPRESSION OF INTEREST FOR IMPLEMENTATION OF TELE MEDICINE IN UTTARAKHAND IN PUBLIC PRIVATE PARTNERSHIP (PPP) MODE

Note : register this file you are can jur proces

1. ()
2. ()
3. ()

Odisha has adopted ICT as development tool

- Odisha, the first state in the country has adopted ICT as a state development tool for providing healthcare services at the door step of the citizen.
- OTTET in collaboration with Govt. of Odisha and National Resource Center for Telemedicine & Biomedical Informatics at SGPGIMS, Lucknow under PPP mode

<http://egov.eletsonline.com/2013/03/odisha-has-adopted-ict-as-development-tool/>

Uttaranchal Mobile Health Clinic



Opportunities and Challenges

Opportunities

- Vast and diverse geography with dominant rural population
- Disparity in healthcare infrastructure
- Low cost local technical solution & ICT expertise
- Fast adoption of Mobile technology (Crossing 927 Million)
- Successful pilot projects
- Policy on adoption of ICT in service delivery 12th Plan
- Budget Allocation under National Rural Health Mission
- National Knowledge Network (NKN)
- National Optic Fiber Network (NOFN) reaching 250,000 *grampanchayat* (Village Level Administration Point).
- National eHealth Authority
- Digital India Campaign

Challenges 1

- Evaluation & Identification of Best Telemedicine Practices
- Confidentiality & Security of Personal Health Record
- Credentials and competence of the remote physician
- Legal, ethical and social issues yet to be addressed
- Broadband internet yet to be operational in Rural
- NGN like Wi Max and 3G not widely available

Challenges 2

- E-health adoption by stake holders
- e-Health Program sustainability Models
- Inter-operability of e Health system
- Integration into prevailing Health System
- Development of National e-Health Observatory
- Capacity Building in e-health System
- Research & Development in e-health technology and system appropriate for local situation with global impact

Video Demonstration

Module I : Pack/Suitcase Telemedicine

Module II: Teleconsultation Process



Thank You



School of Telemedicine & Biomedical Informatics

National Resource Center : MCIT & MoH&FW, Govt. of India

www.sgpgi-telemedicine.org | www.stbmi.ac.in | www.nrct.in

[Virtual Tour](#)

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