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


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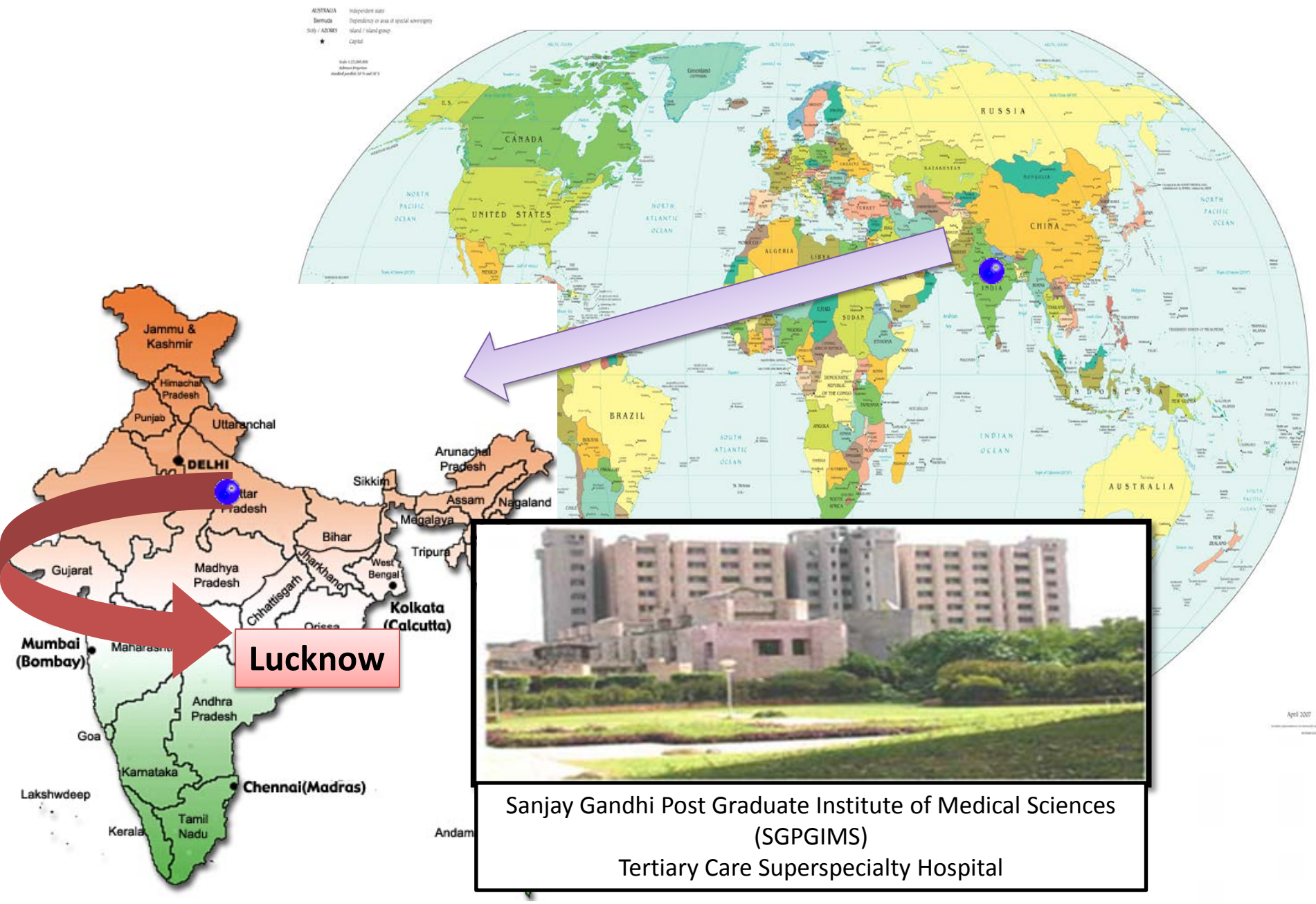
ITU Regional Workshop for CIS on Use of ICT for Health Protection. Telemedicine Services, Including in Rural and Remote Areas Tashkent, Republic of Uzbekistan, 7-9 October 2015

# 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






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


- 74.04 % literate population
- 70 million homes have access to TV
- 650,000 existing PCOs ® internet kiosks
- 99, 247 CSCs operational (www.csc.gov.in)
- **Cell phones:** 930.20 million (Sept 2014)
- India is likely to have 314 million mobile Internet users by end of 2017 from 159 million users at present
- Hardware, software and brain ware all available

# 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

Ministry of Health and Family Welfare
Government of India

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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_teleopthalmology_in_tripura.pdf

- Arvind Tele-Ophthalmology

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

- Sankarnethralaya Tele-Opthalmology

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**%20**Rural**%20**Telemedicine**%20Network%20for%20India-...*

# Telemedicine Programmes at Major Academic Medical Institutions

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

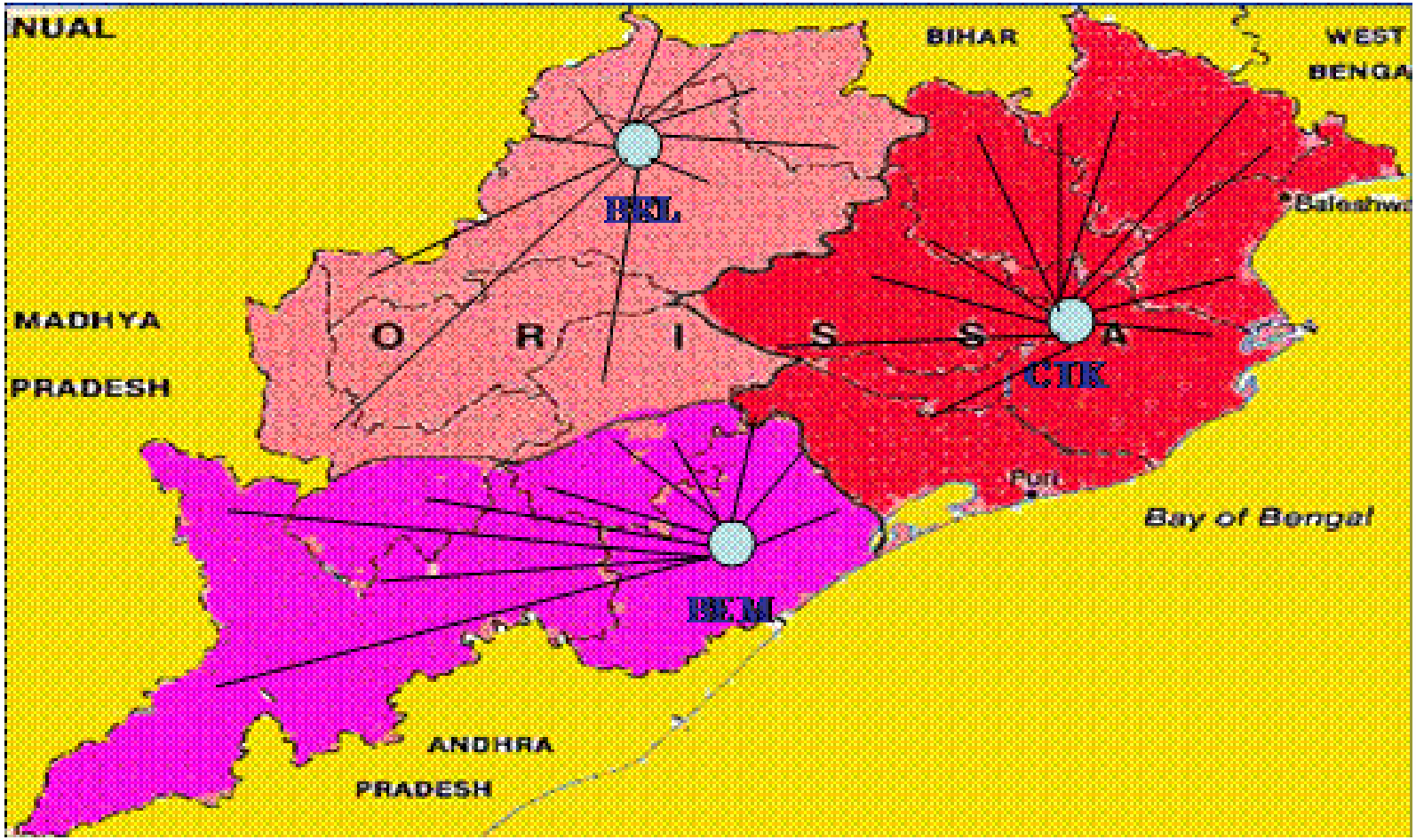
  www.sgpgi-telemedicine.org, www.nrct.in, www.stbmi.ac.in
- All India Institute of Medical Sciences, New Delhi http://www.aiims.edu/aiims/telemedicine/telepage.htm
- Post Graduate Institute of Medical Education & Research, Chandigarh http://pgimer.nic.in/code/telecentre/html/intro.htm
- Tata Memorial 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

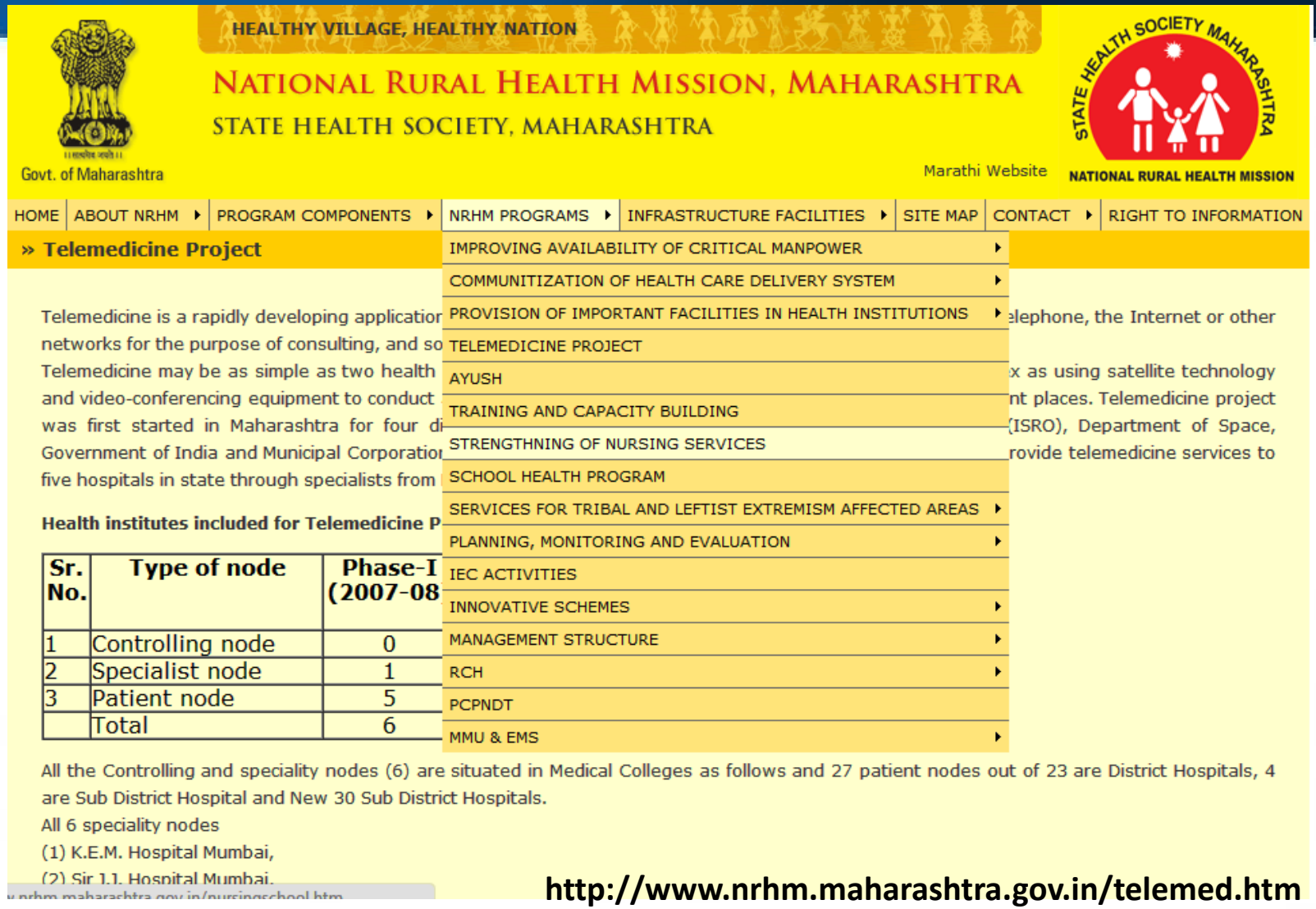
# State Government Initiatives under National Rural Health Mission (NRHM)

# Orissa Telemedicine Network




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

# NRHM Maharashtra




**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, GoI. 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

# 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

Weighing Machine

$SPO_2$

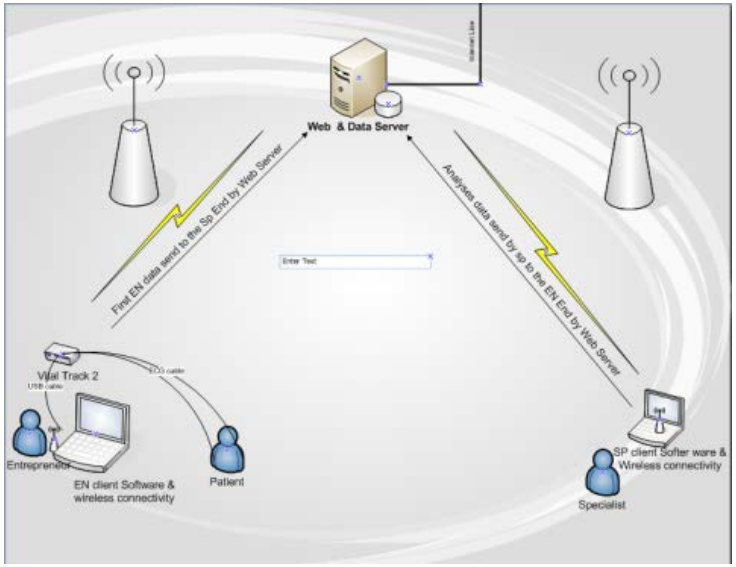
ECG

**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



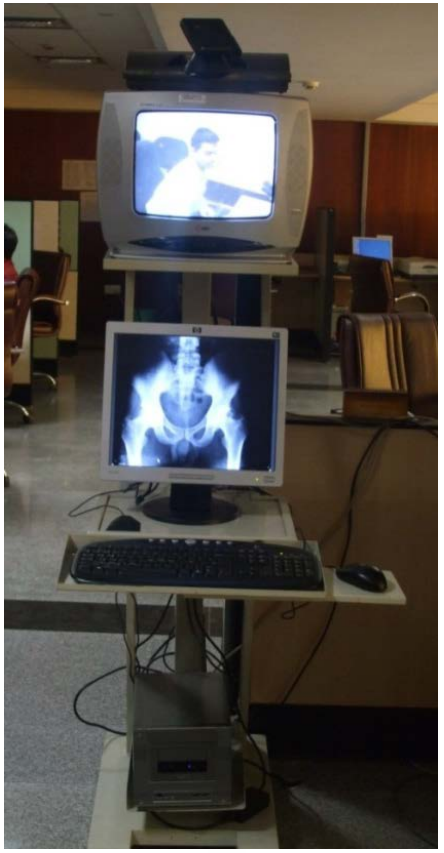

**Network Architecture**

**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

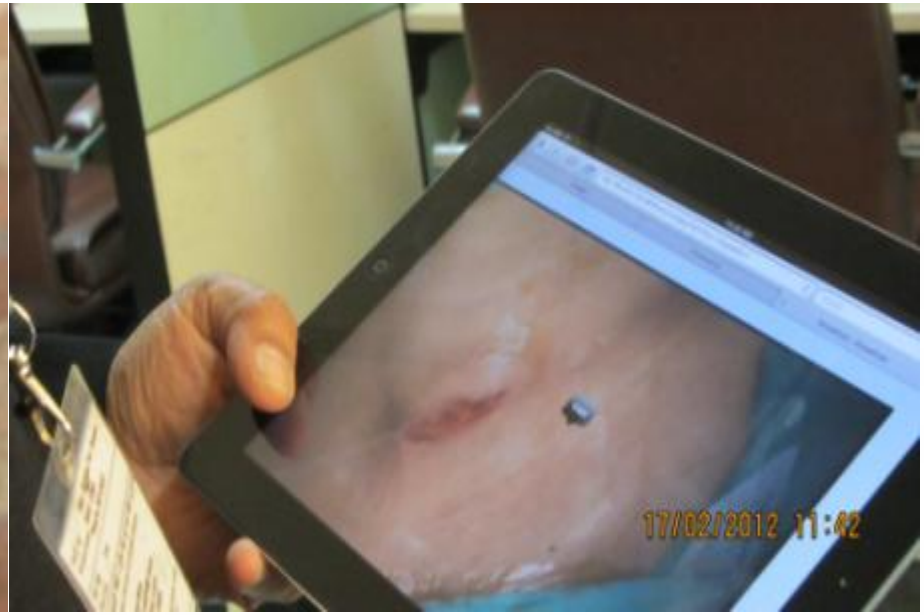
Department's Seminar Room

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

# 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

# ICT Enabled Medical Education

- 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)

# ICT Enabled Medical Education

- 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.

**www.smarteach.com**

# SmarTeach® *on Tab (UGMed)*

MEdRC
The Heart of Learning

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)

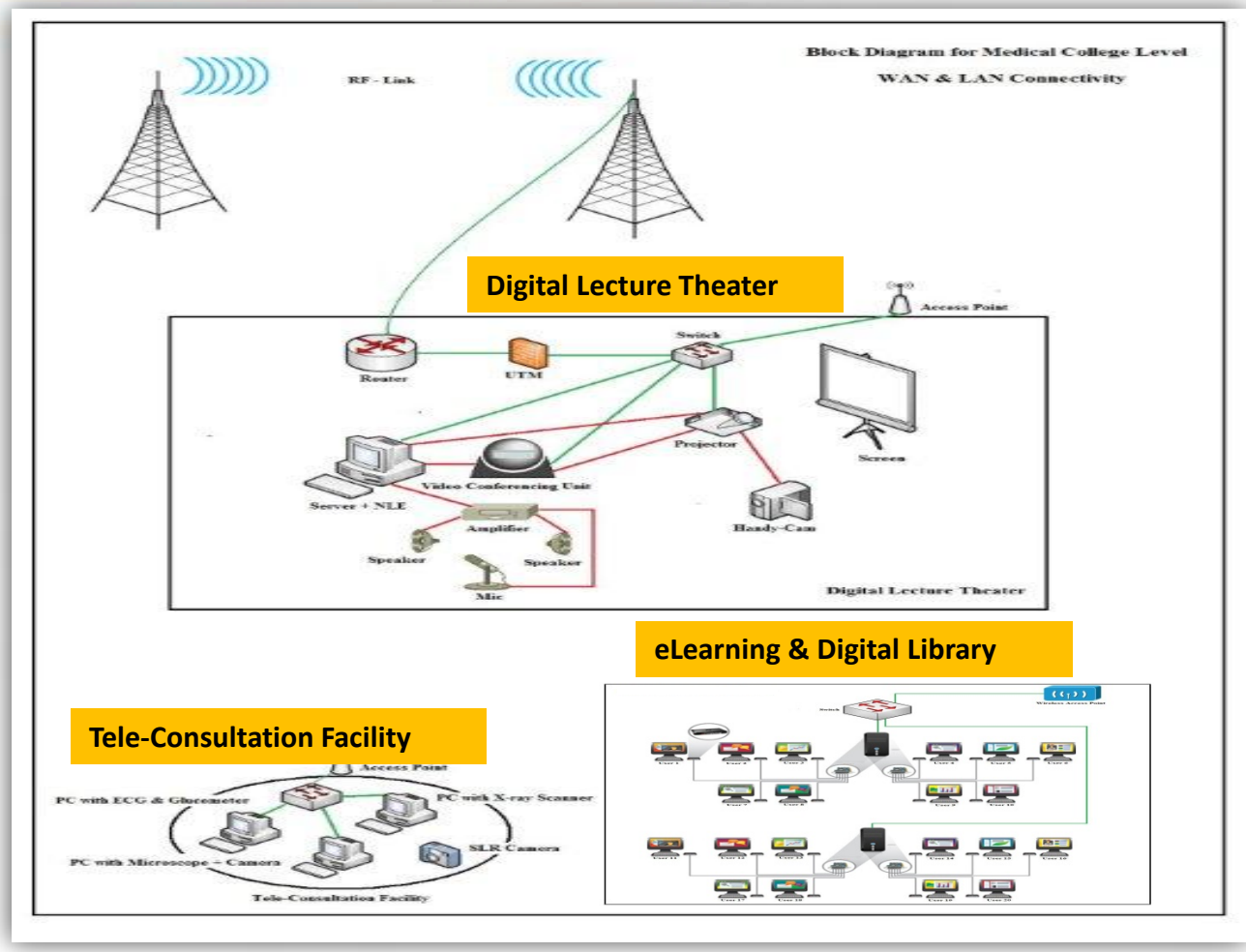
National Resource Center

06 Regional Resource Center

All govt. Medical Colleges

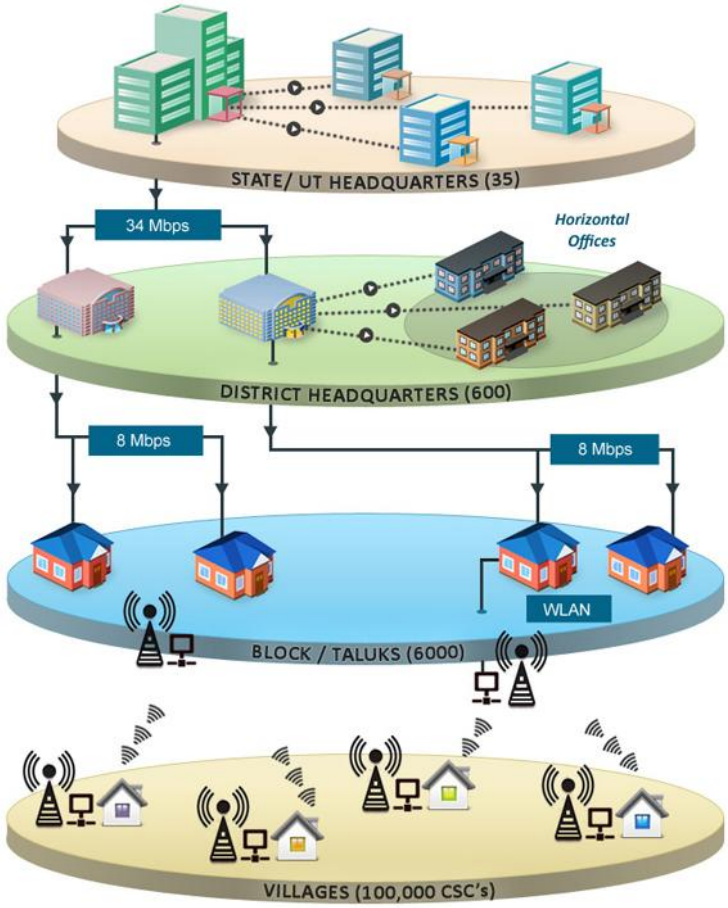
# UP Medical College Network

## Block Diagram for Medical College Level : WAN & LAN Connectivity

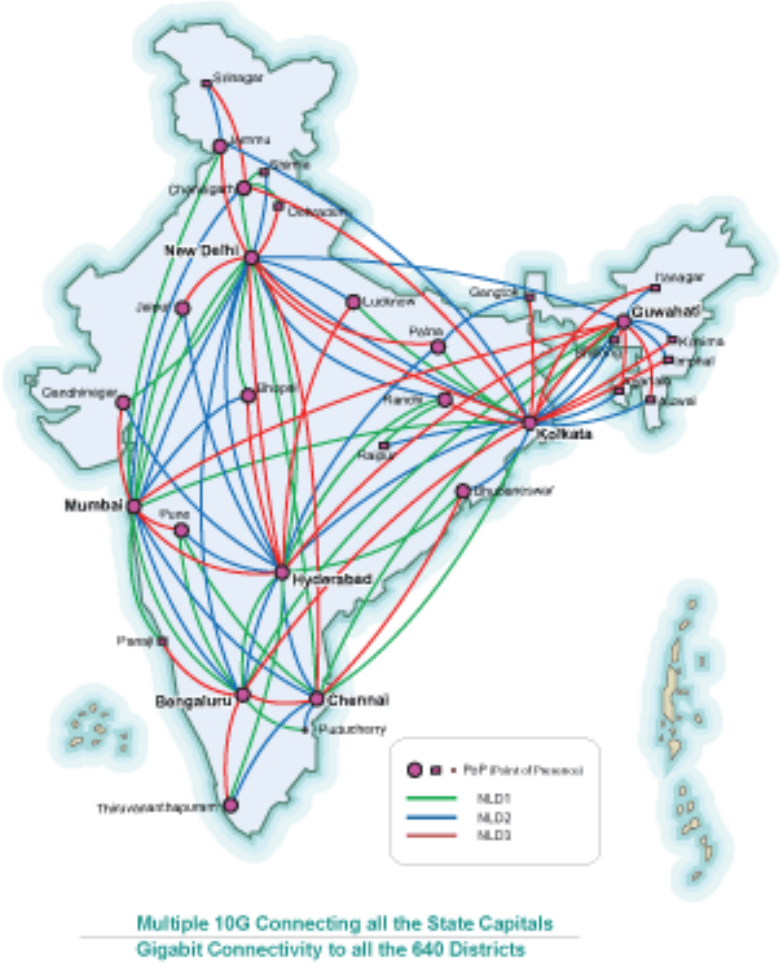


# National Telemedicine GRID

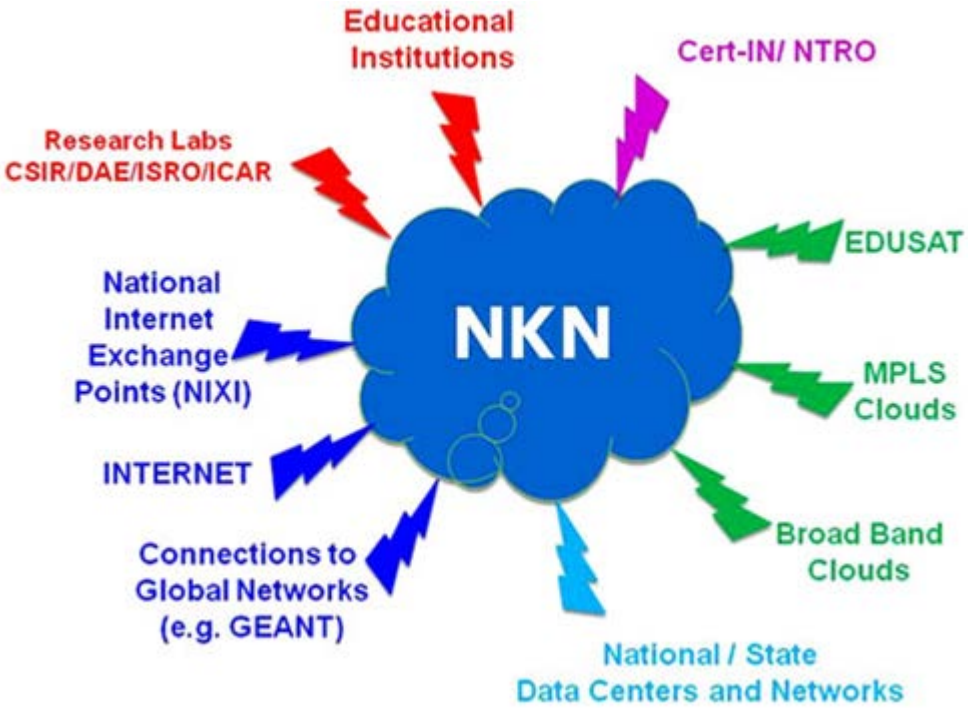
- **National Knowledge Network** (NKN)
- **National Optic Fiber Network** (NOFN)
- **State Wide Area Network** (SWAN)



# NKN




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

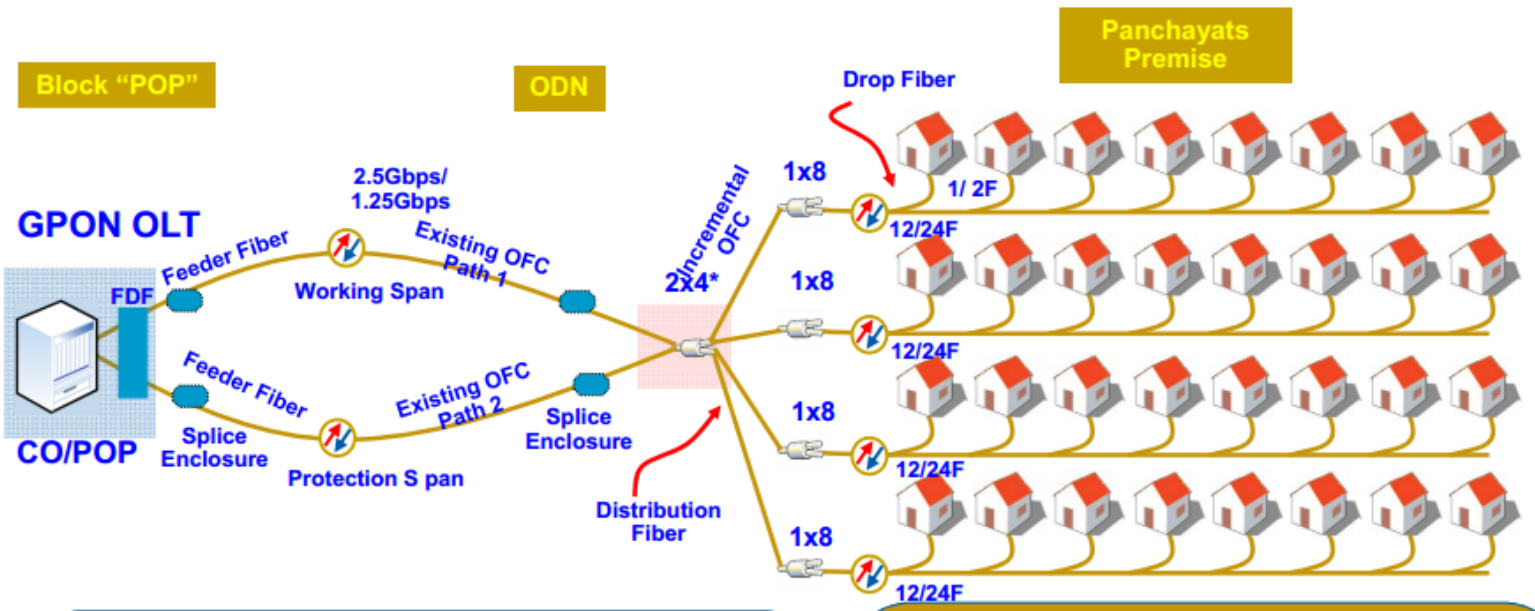



http://www.nic.in/nkn

# NOFN


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

# 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

# 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 12$^{th}$ 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**