



An Overview of SDI Elements and Architecture

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Goal of Development

- Providing a higher quality of life
- Economic route
 - ◆ Financial assistance, responsibility and accountability
 - ◆ Unemployment, price controls, econometric models
- Geo-science based route
 - ◆ Convergence of scientific, technological, economic and social principles
 - ◆ Development of community knowledge systems
 - ◆ The **Geo-engineer** as a facilitator for scientific development planning

Geo-engineering

- Technology (GIS, GPS, Remote sensing, Total Station, Computers, Networking)
- Environmental engineering
- Economics
- Community development
- Social research
- Development planning

Some Definitions

- *Data*: a set of observations about an object or an event
- *Database*: structured and purposeful storage of data
- *Information*: meaningful conclusion derived from data through analysis
- *Knowledge*: A part of human thinking process
- *Decisions*: management actions based wholly or partly on information

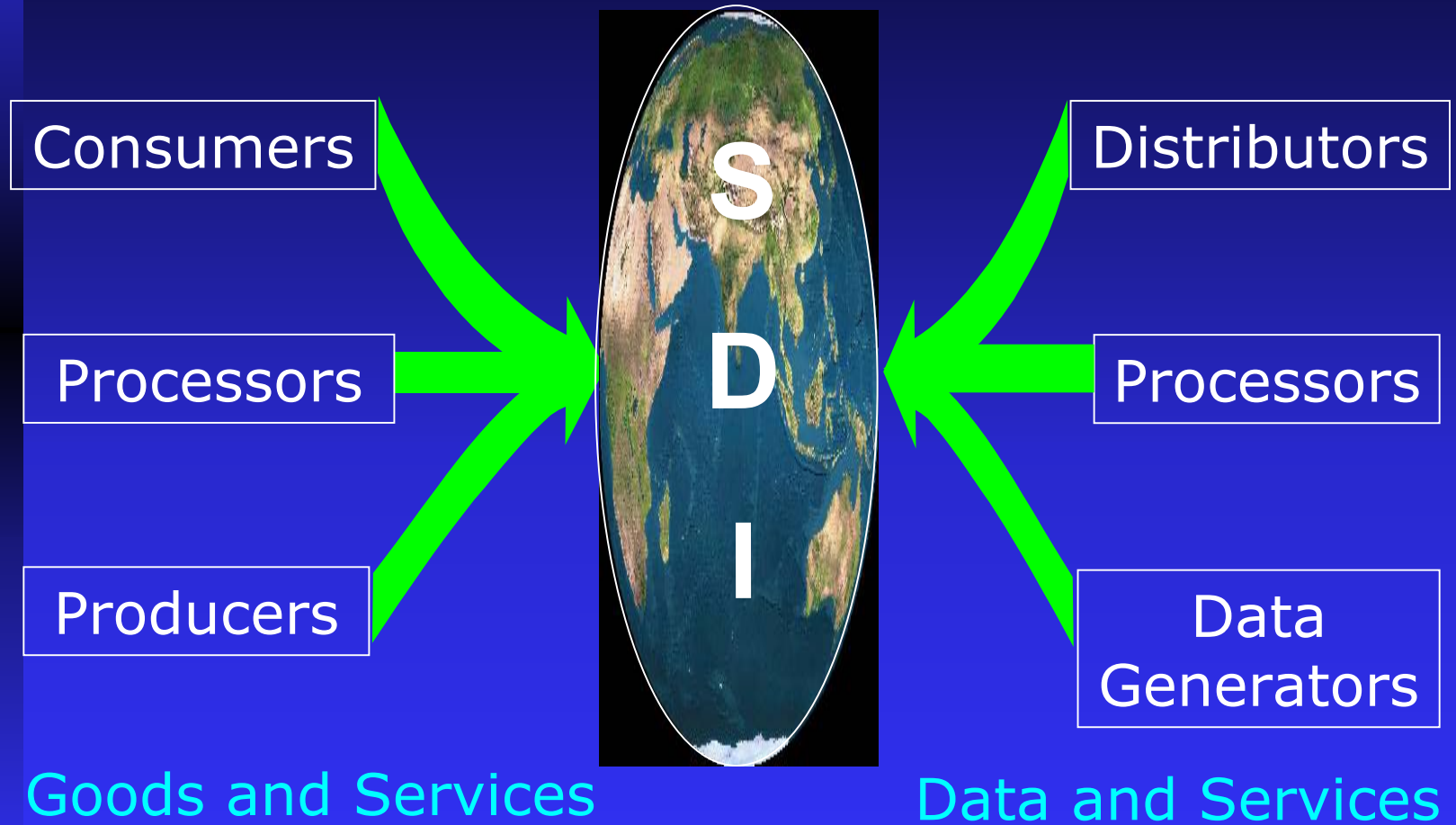
Information - For Whom?

- Stakeholders
 - ◆ Primary producers
 - ☞ Farmers
 - ☞ Labour
 - ◆ Secondary processors
 - ☞ Food processing industry
 - ☞ Energy generators
 - ◆ Consumers
- Managers in government and industry

What Information ?

- Specific areas of interest to the stakeholder
 - ◆ Will ensure information is sought, even on payment, and used
- Over-arching need: sustainable economic development
- Universal and region specific models for generating decision alternatives
- Measure and estimate the progress of development on the basis of criteria developed specifically for this purpose

The Role of the SDI



The Indian SDI Community

- Data generators - NRSA
 - ◆ Efficient distribution of data
- Value adders - commercial entities
 - ◆ Wide choice of data suites, marketing channels
- Information users - administrators, co-operatives, common man
 - ◆ Reliable and cheap information

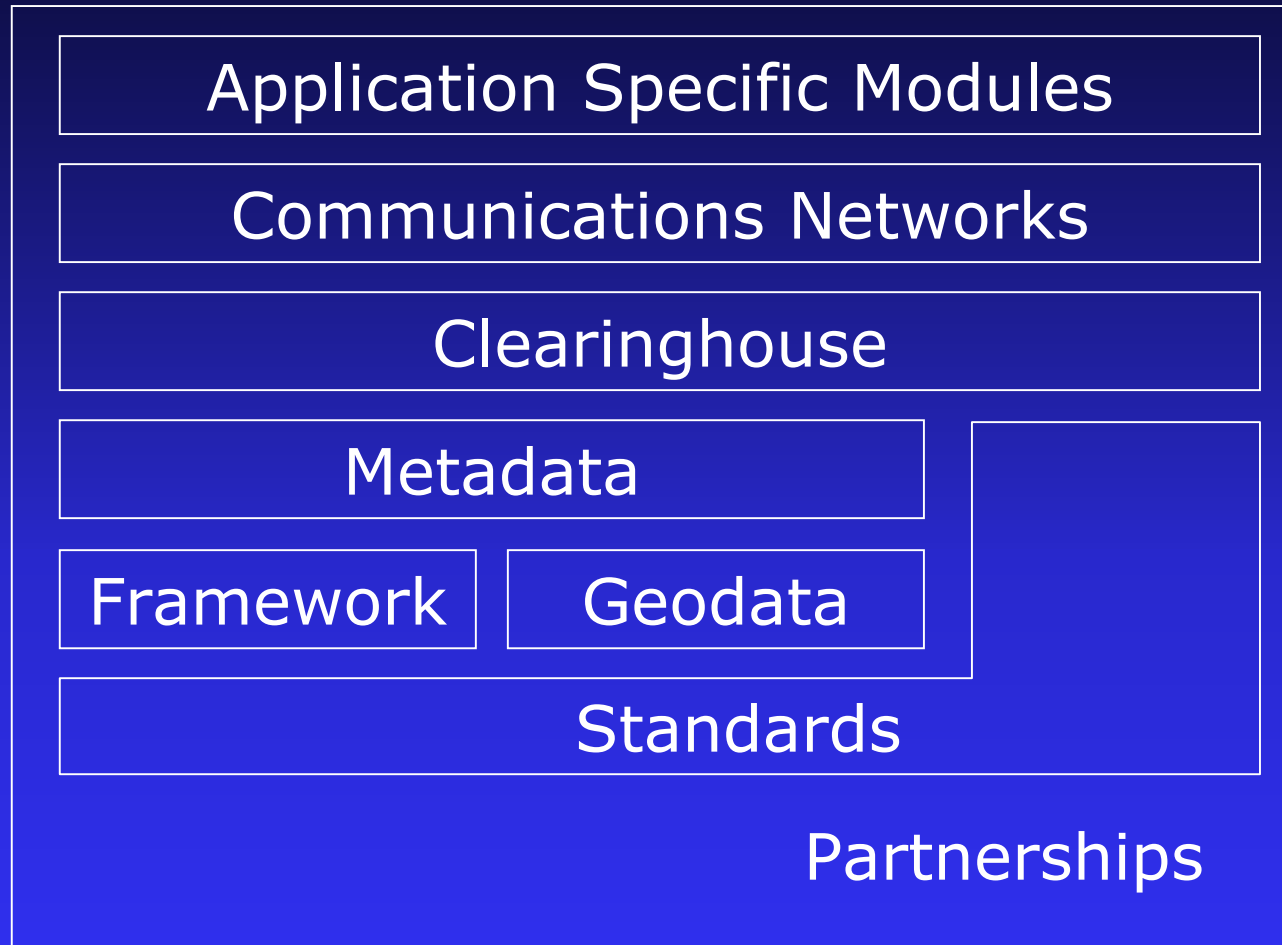
Key Areas for Development

- Land and water management
- Infrastructure development
- Delivery of social services: public health and education
- Disaster warning, prevention, mitigation and downstream relief and rehabilitation

Definition of SDI

- Technologies, policies, standards and human resources for data acquisition, processing, storage, distribution and enhanced utilisation
- Transparent availability and accessibility of geo-spatial data
- Interdisciplinary collaboration and co-operation
- Common and consistent infrastructure for storage and delivery of public and private data for community activities

Technological Components of SDI



Administrative Components of SDI

- Distribution mechanisms
- Access policy and regulation
- User interface
- Training
- Human and financial resources

Geodata

- Remote Sensing
- Surveying
- Rapid Appraisal
- Accuracy
- Currency
- Consistency
- Uniqueness

Standards

- Formats
- Contents
- Exchange
- Source
- Update cycles
- Verification & Validation
- Geoid
- Projection
- Scale
- Minimum Mapping Unit
- Mapping Error
- Database Structure
- Field Names
- Thematic Class hierarchy

Spatial Framework

- Latitude and longitude framework with tics to provide an invariant reference for all spatial data
- Include elevation, bathymetry, geodetic control, transportation, administrative boundaries
- Built on a reference geoid using a common projection

Metadata

- Custodian
- Data description
- Geographic extent
- Currency
- Storage format
- Data Quality
- Contact Information

Clearinghouse

- Mechanism for access to metadata
- Network
- Search Engines
- Standardised access procedures
- Z39.90 Standard
- Metadata Engine

Communications Network

- TCP/IP based Internet/Intranet
- Standard GUI
- XML
- Bandwidth
- Transport layer - OFC, copper, Space

Application Specific Modules

- Simple query
- Advanced query
- Decision Support
- Customisable
- Extensible

Technological Challenges

- Definition and finalisation of a Civilian spatial framework
- Finalisation of Standards for SDI
- Conversion of Legacy Data
- Creation of metadata, search engines, etc
- Activation of Clearinghouses
- Realisation of a broadband network
- Development of web based application modules

NRIS: A Case Study

Major Objective

Provide information on various planning scenarios to decision makers for sustainable development of both land and water resources in districts and states.

Detailed Objectives

- Digital database of thematic maps generated on 1:50,000 & 1: 250,000 scale & link them through suitable network
- Integrate thematic information in GIS environment to draw locale specific action plans for land and water resources & socio-economic development in district
- Generate query shells for data retrieval and generation of action plans interactively for decision making

NRIS Database - Primary Elements

SPATIAL

- Landuse / cover map
- Geomorphic units & Landforms
- Lithological units
- Geological structures
- Soil type, depth, texture etc
- Drainage
- Canals
- Elevation contours/ spot height points
- Watershed hierarchy polygons
- State/District boundaries
- District/Taluka boundaries
- Village boundaries
- Forest management boundaries
- Location of Wells

- Settlement locations
- Roads
- Rail network
- Rail network along with Railway Stations
- Rainfall / temp observation
- Minerals
- SOI toposheet references

ASPATIAL

- Demography
- Occupation
- Education Facilities
- Medical Facilities
- Communications
- General
- Land Use
- Power

Database Standardization

- Spatial framework
 - ◆ Multi-layer registration scheme
 - ◆ Co-ordinate/ projection system
- Feature codification
 - ◆ Harmonization of various mapping legends
 - ◆ Encompasses natural & administrative hierarchy
 - ◆ Tie-up with collateral data sources
 - ↳ SOI, census, NIC, & BES
- Database quality standards

Standardisation Parameters

■ Input specifications

- ◆ Location reference
- ◆ Scale
- ◆ Projection/map standard
- ◆ Thematic accuracy
- ◆ Control accuracy
- ◆ Legends

■ Database specifications

- ◆ Spatial framework
 - ◆ Accuracy/error limits
- ## ■ Acceptance criteria

Sample Design Standard

| NODE DATABASE DESIGN SPECIFICATIONS | | | | | |
|--|---|---|-------------------|--------------------|--|
| | | District Node | State Node | Centre Node | |
| A. Input Specifications | | | | | |
| 1 | Location Reference | .Latitude-Longitude/ Permanent features | | | |
| 2. | Scale | 1:50,000 | 1:250,000 | 1:1,000,000 | |
| 3 | Projection/ Map standard | Preferably polyconic (SOI Base) | | | |
| 4 | Thematic Accuracy | | | | |
| 4.1 | MSU (2mm) | 10000 sq. m | 250000 sq. m | 4000000 sq. m | |
| | | 0.01 sq. Km | 0.25 sq. Km | 4 sq. Km | |
| 4.2 | Mapping | 90/90 | 90/90 | 90/90 | |
| | | Sample checks in field | | | |
| 5 | Control Accuracy (w r t control points on SOI Toposheets) | | | | |
| 5.1 | Planimetric (RMS) | 50 m | 250 m | 1000 m | |

Sample Acceptance Standard

ELEMENT SPECIFIC REFERENCES FOR ACCEPTANCE OF INPUTS

| Element | Level of Details | | | Acceptable Age/ Update frequency |
|--------------|--------------------------|------------------------------|-----------------------|-------------------------------------|
| | District (1:50000 scale) | State (1:250000 scale) | Centre (1:1M scale) | |
| LUSE | Level-III | Level-II | Level-I | 2 yr. |
| GEOM | Landforms | Geomorphic Units | Physiographic Units | 10 Yr. for Coastal/ Deltaic Regions |
| LITHO | Lithologic units | Rock Group/ Lithologic units | Rock groups | |
| SOIL | Soil series Association | Family Association | Sub-group Association | 10 yr. |

NRIS Database Access Shells

- Simple and Functional Menu Based Access
- Transparent to the User
 - ◆ No need to understand database and GIS technology
- Generalized Query Shell
- Spatial Decision Support Shells, SDSS
- Analysis and Planning Models

Query Shells

- Query by specific area, e.g. Block, etc.
- Select only required data elements
- Specify conditions, e.g. greater than, equal to, sum of, etc.
- Do 'Where is this' and 'What is this' queries
- Complex queries built from simple queries
- Interactive, on screen presentation of results

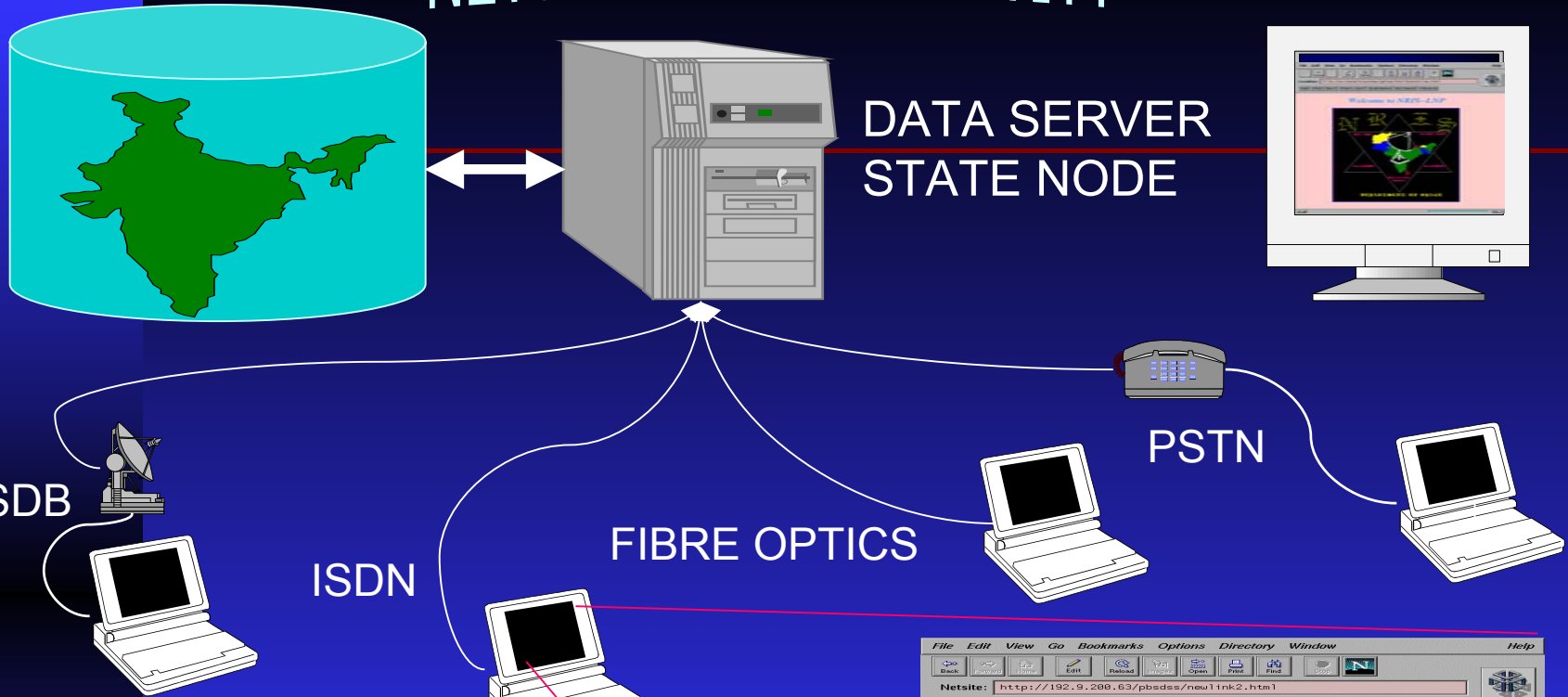
SDSS and Application Models

- Problem specific
- Generates 'what if' Scenarios
- Based on Application Models specified a priori
 - ◆ IMSD Water Resource Action Plan
 - ◆ IMSD Land resource Action Plan
- More models can be added as per need

Procedures Established

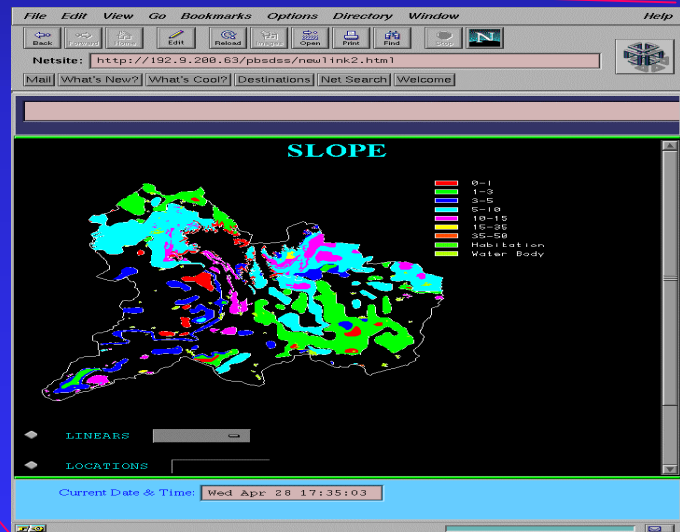
- Database creation
 - ◆ Input data quality verification by quantitative methods
 - ◆ Vendors qualified
 - ◆ Output data quality evaluation
- Database validation
 - ◆ Procedure automated through a master shell for checking the design/ structure of databases against laid down standards
- Shell integration
 - ◆ Single, easy to operate procedure for shell installation and integration with different databases
- Training
- Extension to execution level

NETWORK CONNECTIVITY



- Low Cost Thin Clients
- Quick Data Dissemination
- Data Security
- Easy Viewing & Querying
- Information available on desktop

Web Access



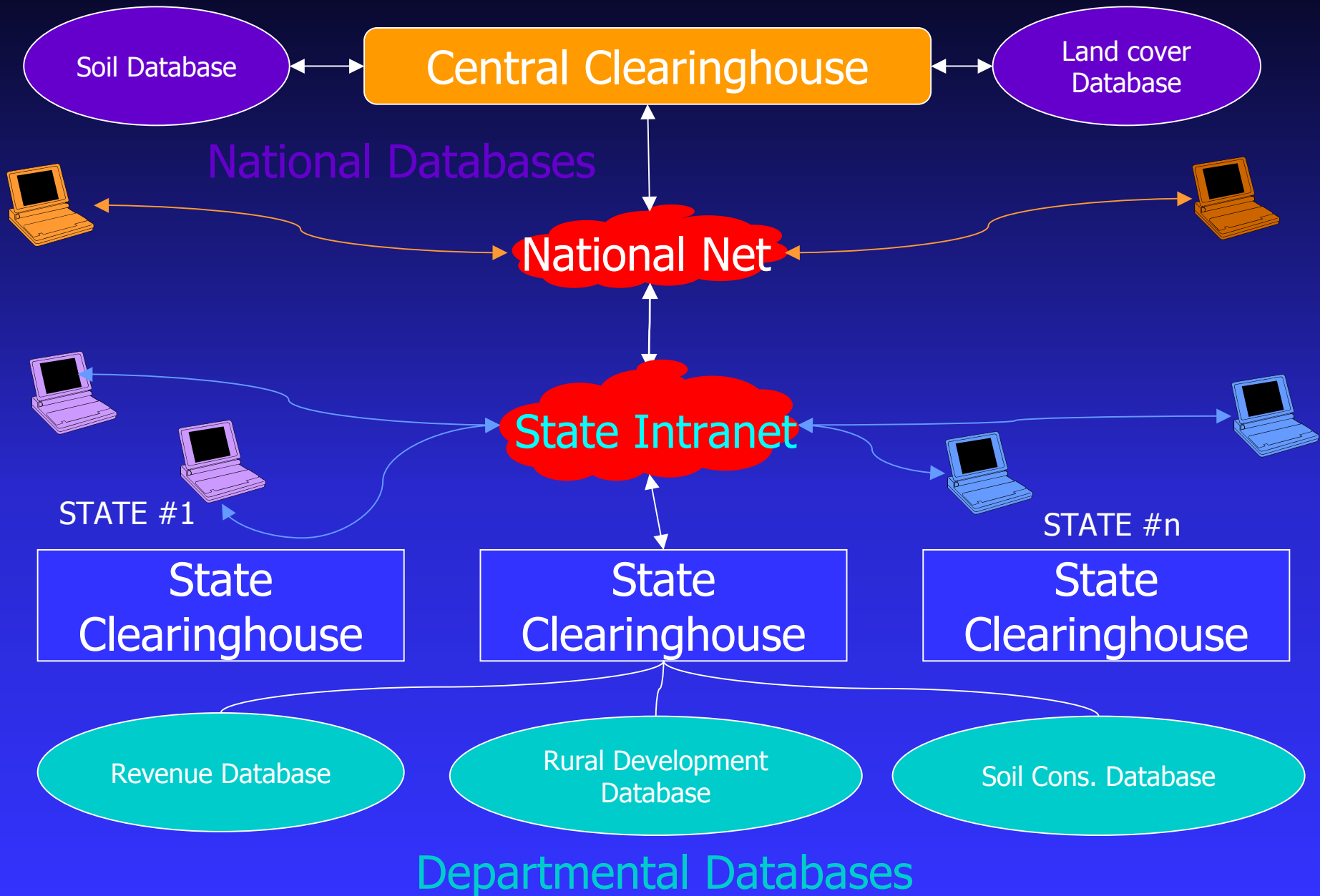
Infrastructure Development

- Data Bases Standardization
- Easy Access Mechanism Through Query & DSS
- Procedures For Database Creation & Validation
- Training - In Phased Manner
- Vendor Qualification For Database Creation
- Vendor Development For Future Application Shells Realization
- Selection and deployment of hardware and software
- Evaluation of information delivery systems
- Mechanism for updating Standards
- Mechanism for user feedback and user directed applications development

User Training

- Training on GIS for State Remote Sensing Centres
- Training on User Shells
- State Centres will train end users on use of system

The NSDI Model



The Road Ahead

- Create awareness and support among users
- Identify and involve all stakeholders
- Complement related initiatives
- Evolve supportive policies
- Address legal, IPR and commercial issues
- Mobilise resources

For more information:

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Thank You