UNITED NATIONS STATISTICAL COMMISSION and ECONOMIC COMMISSION FOR EUROPE CONFERENCE OF EUROPEAN STATISTICIANS

EUROPEAN COMMISSION STATISTICAL OFFICE OF THE EUROPEAN COMMUNITIES (EUROSTAT)

ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD) STATISTICS DIRECTORATE

Meeting on the Management of Statistical Information Systems (MSIS 2008)
(Luxembourg, 7-9 April 2008)

Topic (ii): Statistical information systems architecture

IT ARCHITECTURE FOR THE MEXICAN STATISTICAL AND GEOGRAPHICAL INFORMATION NETWORK

Supporting Paper

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I.   INTRODUCTION

1.   INEGI is the main producer of statistical and geographical information in Mexico. Nevertheless, INEGI is not the only producer of statistical data in the country. A second role of INEGI is as a coordinator of these statistical information production units. It's necessary to build the infrastructure to accomplish this complex job.

2.   In this paper we're going to describe the IT architecture that INEGI is designing to meet the requirements of a nationwide system that will support production, exchange, distribution and safeguard of statistical and geographical information of national relevance. This system will be established and supported by a federal law that is in its approval process. Please note that the rest of the paper has been written in present tense, but this is a planned system that is under development.

II.   CONTEXT

A.   The National Statistical and Geographical Information System of Mexico

3.   The meaning of the conceptual architecture described in this document should be understood within the framework of a federal law that defines the National Statistical and Geographic Information (SNIEG[1]) of the Mexican Estate.

4.   The National Statistical and Geographic Information is a collection of units organized through Subsystems, coordinated by the National Institute of Statistics and Geography (INEGI[2]) and articulated by
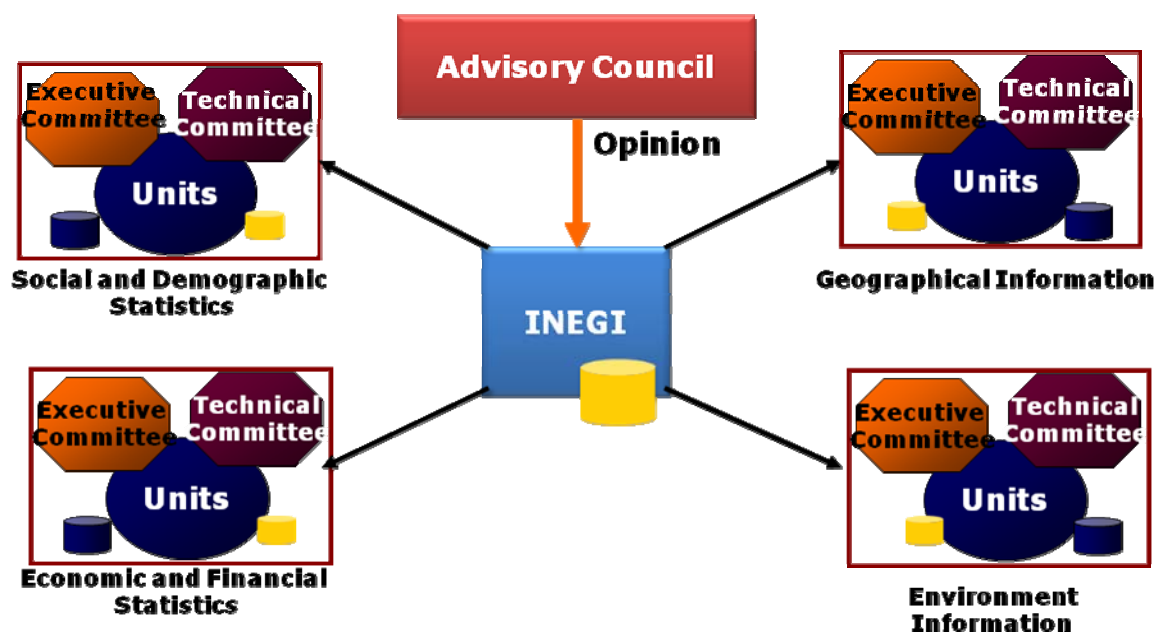
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[1] In Spanish: Sistema Nacional de Información Estadística y Geográfica
[2] In Spanish: Instittuto Nacional de Estadística, Geografía e Informática

the National Information Network (RNI[3]), in order to produce and disseminate Statistical and Geographical Information of National Relevance.

5. The SNIEG consists of three major components which are: the National Consultative Council, the National Information Subsystems and the National Institute of Statistics and Geography (INEGI).

6. National Consultative Council is composed by: the president of the INEGI, a representative from each Federal Department of the Executive Branch, a representative of the Judicial Branch, a representative of the Chamber of Deputies, a representative of the Senate and five representatives of State Governments that correspond to different geographical regions of the country.

Figure 1: Coordination of the SNIEG

7. SNIEG has been divided in four subsystems: 1) Demographic and Social Information, 2) Economic Information, 3) Geographical Information and 4) Environment Information. Each of these subsystems is responsible for producing the information in the national relevance that relates to its own name.

8. State units (Units) that conform to the subsystems are areas which are producers of Statistical and Geographical information, owners of administrative records that can be used to obtain information of national relevance.

9. Each subsystem has an Executive Committee which consists of a vice-chairperson from the Governing Board of INEGI and a group of coordinators of the units that comprise them. These committees follow up the projects established in the annual programmes of statistics and geography, and also they give their opinion to make improvements in those programs and the indicators they produce.
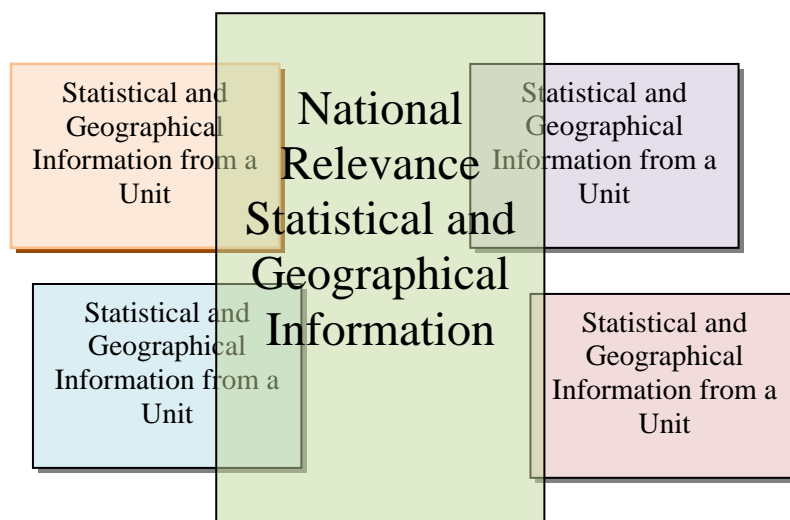
10. Subsystems have specialized technical committees established by the Board of Governors of the Institute. These bodies for collegiate participation and consultation are composed of representatives of the Units and INEGI. Its main tasks are development, review and revision of technical standards to be issued by the Institute.

11. RNI is defined as a set of processes made to support exchange and safeguard of information in the SNIEG. These processes are made to coordinate the system and to support the public statistical and geographical information service for Mexican society.

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[3] In Spanish: Red Nacional de Información

12.   SNIEG seeks to provide accurate, reliable and timely information with a high quality degree, to assist the national development. To accomplish this purpose, the system has defined four primary objectives:
  1) Produce information
  2) To disseminate timely information through suitable mechanisms for their use
  3) To promote awareness and use of the information
  4) Safeguard information

Figure 2: Composition of the Information of National Relevance

13.   Not all statistical and geographic information that is produced in Mexico is subject to be in the System, the SNIEG must deal with information that is of National Relevance as far as determined by the Governing Board of INEGI (see Figure 2).

14.   The law of the National System of Statistical and Geographic Information states that the information is of National Relevance is:
  1) Information produced exclusively by INEGI through: the National Census, the System of National Accounts and the National Consumer and Producer Index of Prices.
  2) Information that meets the following four criteria:
    I. Related to one of the following topics, or groups of data indicators: population and demographic dynamics, health, education, employment, income distribution and poverty, public security and administration of justice; government; housing; system of national accounts; financial information; prices ; work; science and technology; atmosphere, biodiversity, water, land, flora, fauna, hazardous waste and solid waste; geodesic frame of reference; coastal boundaries, international, state and municipal data underline continental, insular and submarine; cadastral , topography, natural resources and climate and geographical names, or matters that are approved unanimously by the National Consultative Council, including those who should know the Subsystems for the proper functioning of the system.
    II. Required to support the design and evaluation of public policies of national scope.
    III. Generated in a regular, periodic basis.
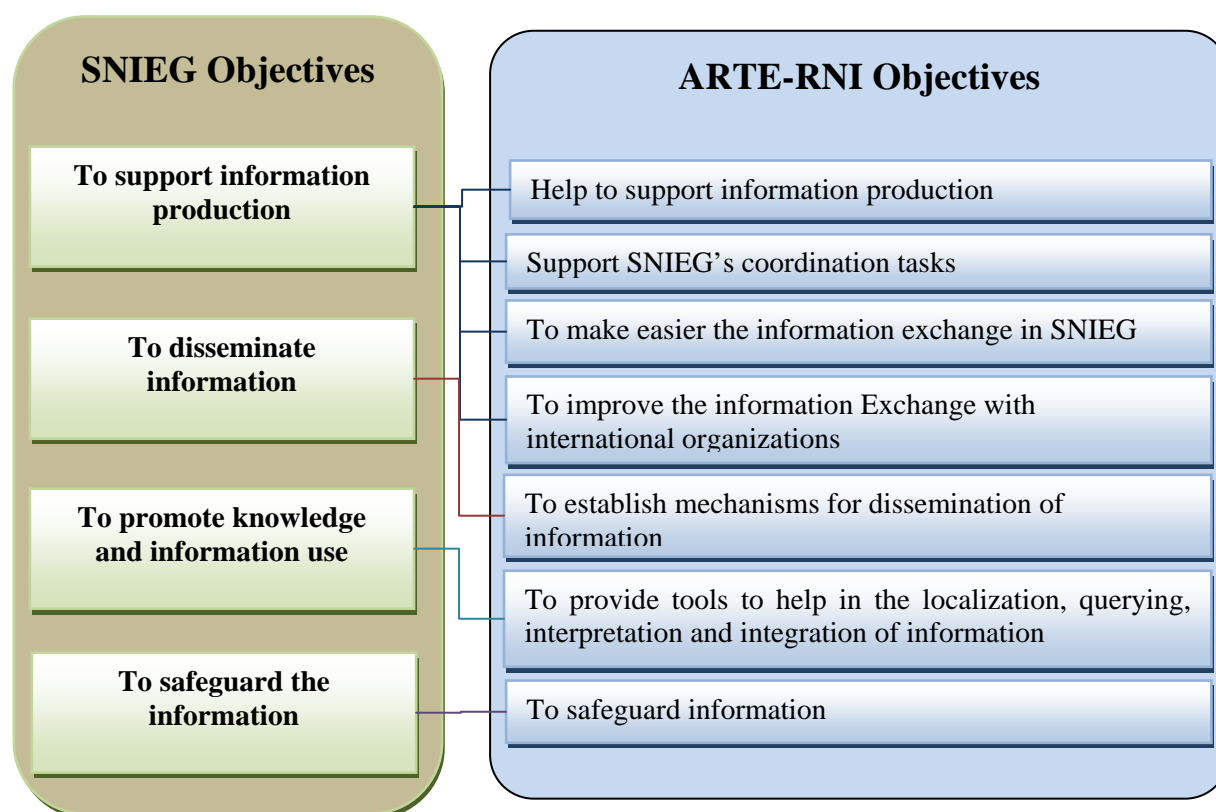   IV. Based in a scientific methodology.

15.   To cope with the fundamental objectives of SNIEG under the criteria established by the mentioned law, it is essential to establish a huge technological system to provide support and services for collection, integration, processing, storage, dissemination and sharing of statistical and geographic information of the country.

II.   Technological Architecture of the National Information System (ARTE-RNI[4])

A.   The Logical Networks

16.   The technological architecture of the National Information Network (ARTE-RNI) is a coordinated set of elements of hardware, software, people, technology standards and guidelines which provide support to the National Information Network.
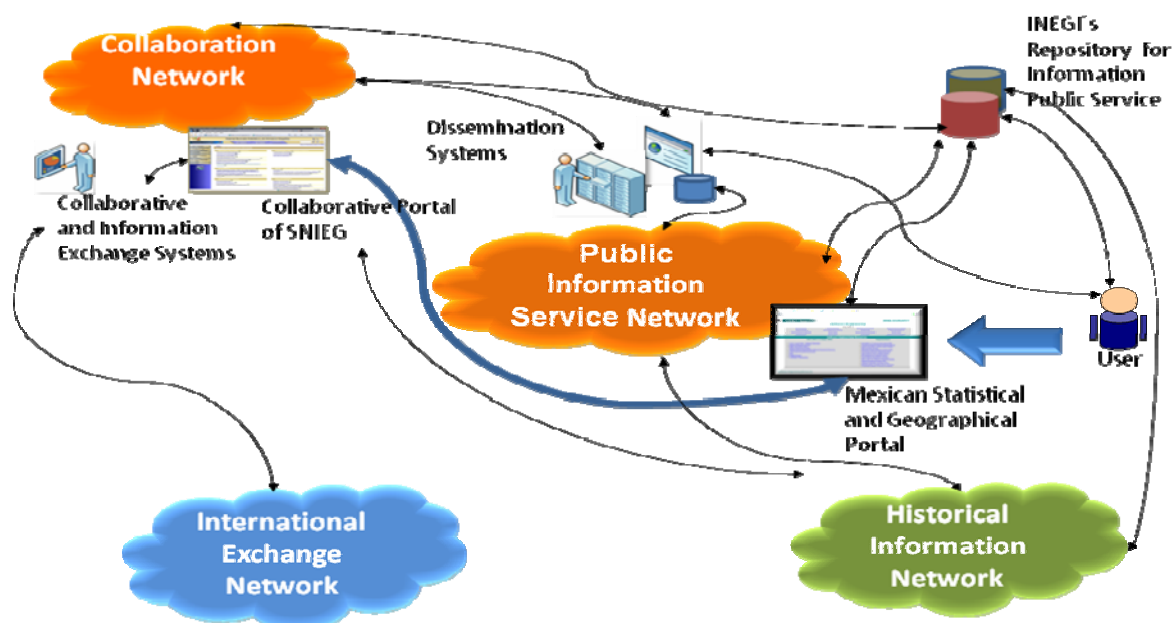
17.   The main purpose of ARTE-RNI is to provide technological support to facilitate the processes that take place within the National Statistical and Geographic Information Network to produce and disseminate information of National Relevance.

SNIEG Objectives	ARTE-RNI Objectives
To support information production	Help to support information production
	Support SNIEG's coordination tasks
To disseminate information	To make easier the information exchange in SNIEG
	To improve the information Exchange with international organizations
To promote knowledge and information use	To establish mechanisms for dissemination of information
	To provide tools to help in the localization, querying, interpretation and integration of information
To safeguard the information	To safeguard information

Figure 3: Objectives mapping from SNIEG to ARTE-RNI

18.   As can be seen in Figure 3, ARTE-RNI goals are aligned with the objectives of SNIEG.

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[4] In Spanish: Arquitectura Tecnológica de la Red Nacional de Información

Figure 4: Logical Networks of ARTE-RNI

19.   To meet all the ARTE-RNI objectives is necessary to divide the system into four groups with different and specific targets. These groups are described as the logical networks of ARTE-RNI:

> 1. Collaboration Network: It is an extranet that facilitates the work of production, exchange and coordination among members of SNIEG (Goals 1 to 3).
>
> 2. International Exchange Network: This is a subnet of the Collaboration Network that is dedicated to support collaboration, exchange and dissemination of statistical and geographic information with international agencies and national statistical and / or geographical offices from other countries (Goal 4).
>
> 3. Public Information Services Network: This is a network for dissemination of information of national relevance to the different sectors of society. It incorporates tools to facilitate the search, query, interpretation and integration with other electronic systems of statistical and geographic information (Goals 5 and 6).
>
> 4. Historical Information Network: It's an external network among the units that keeps private exchanges of data through a public network. The network specializes in distributed storage and retrieval of information of National Relevance in aim to safeguard it (Goal 7).

20.   The four networks are intercommunicated and they provide mechanisms to access resources that are within them. The system also has two special portals, the collaborative portal and the Mexican statistical and geographical portal.
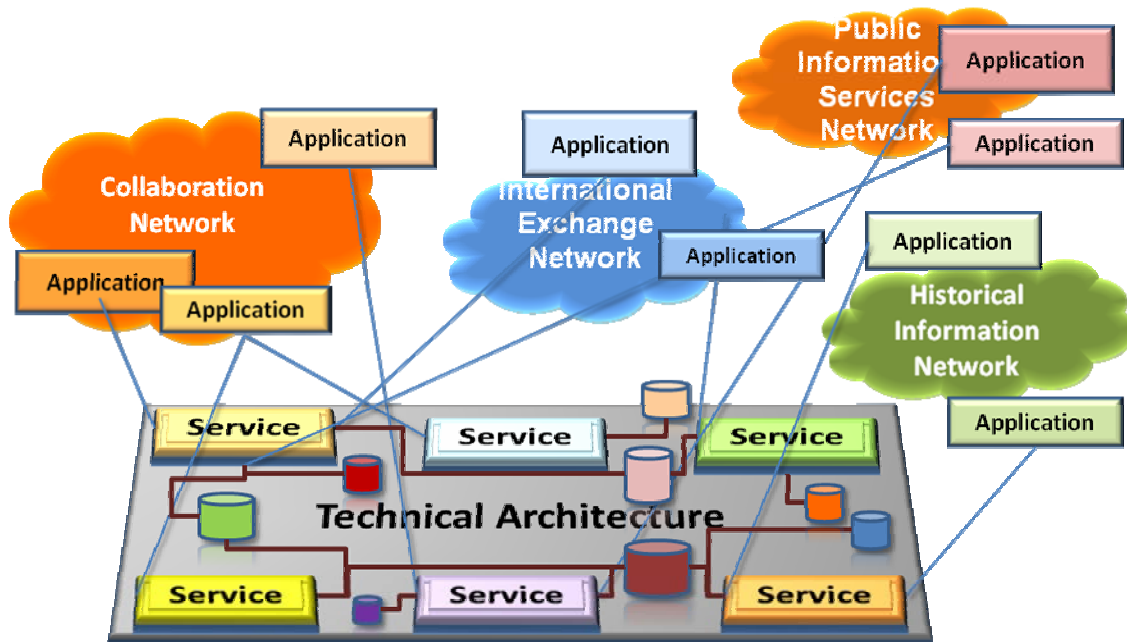
21.   The first one facilitates access to network resources for collaboration and goals support, as well as serving as a contact point for the international exchange of information and storage of historical information.

22.   The second is a portal of public information services, is the main gateway of society to information of National Relevance. It serves as a point of integration by which users can access public information from the entire system utilizing the services and tools. The portal brings several benefits to its users, such as search and integration facilities for distributed information, access and identification of mandatory information, access to methodologies and other types of metadata, etc. This portal also serves as a point where users can find and retrieve information found on the Historical Information Network.

23.   These portals are essential parts of the mechanisms of access to the whole network, but we must remark that they are not the only ways to access the network; they have been conceived to provide services

to people who directly visit the websites. Logical networks also provide various services that software systems can access directly to make use of the SNIEG's information.
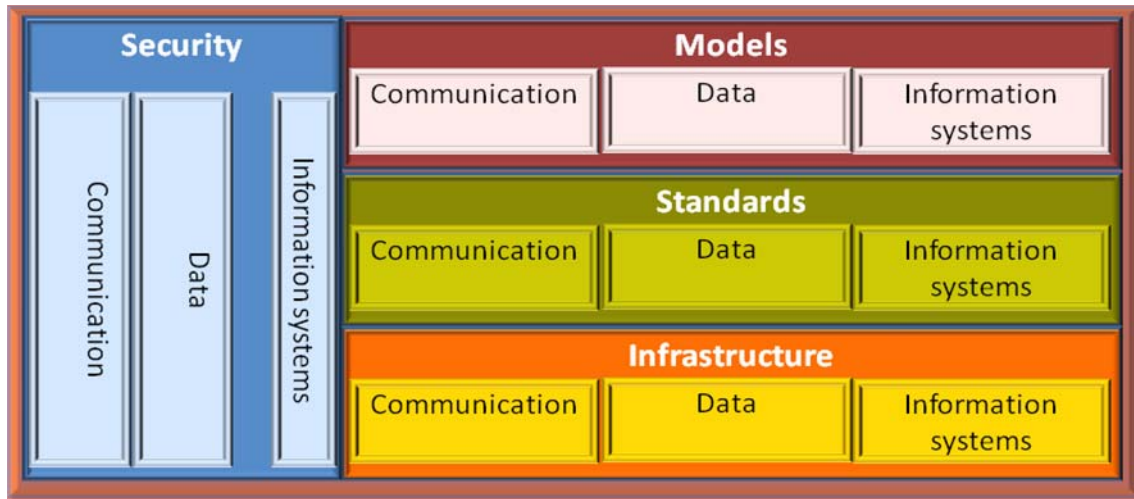
B.   Supporting Architecture

Figure 5; Supporting Architecture for the Logical Networks

24.   Interoperability of different networks is not established through the applications that are part of them, but by a supporting architecture that forms a common infrastructure that provides the interconnection of the various collections of information through communication systems. Supporting architecture share the same standards and information is accessed through services defined with a set of common rules.

25.   Systems integrated to the SNIEG can work independently and contain their own data structures, but adherence to guidelines and the use of the same services allows perceiving all information collections as one big database.

26.   Systems made by the agencies to meet their internal needs are used in the construction and operation of ARTE-RNI. Supporting architecture which is the basis to establish relationships between data collections and software services is defined by four layers. Three of the layers are overlapped and one of them cross them all. These layers are:

1) Infrastructure: Describes aspects of hardware and software that confform the foundation of ARTE-RNI.

2. Standards: Contains communication protocols; languages for structuring, access and use of data; standards to facilitate the exchange of information and specific standards for programming.

3. Models: Integrates well known reference models which describes technological elements that are standard for the IT areas.

4. Safety: Security is established as a cross layer that interacts with the other layers of the architecture, consists of a series of mechanisms, standards and policies to provide: confidentiality, authenticity, integrity, identity, not repudiation, control and availability
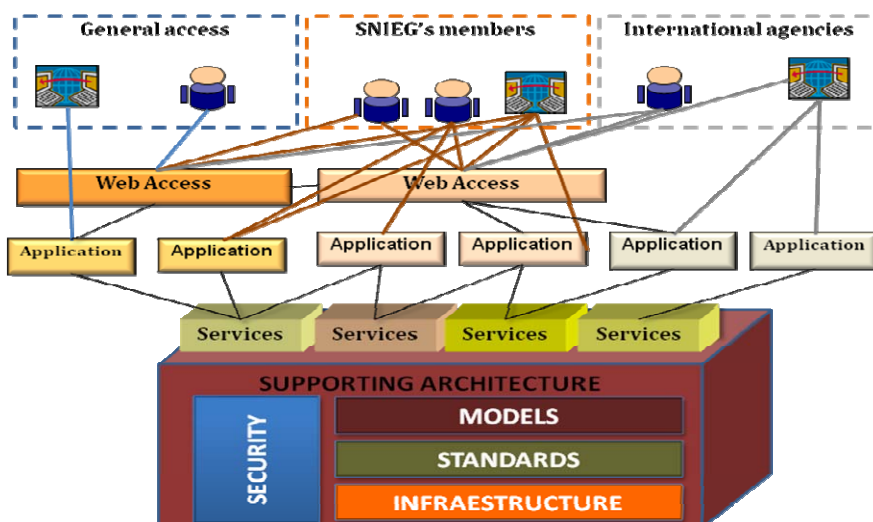
Figure 6; Layers of the Supporting Architecture

27.   Each layer must be described in terms of three dimensions: communications representing interconnections, data representing the collections of information and software systems which represent the rules for building services.

B.   Conceptual Architecture

28.   As already has been described, the conceptual architecture ARTE-RNI provides an IT infrastructure to support integration of different information systems that has been built under different platforms. Data collections and software services are connected into an integrated system. Each service is defined using commonly agreed standards, rules and guidelines and implemented using common software components. These services are used by different applications that meet diverse needs of the members and users of SNIEG. Logical networks are used to focus on specific targets to meet different goals.

Figure 7: Conceptual architecture of ARTE-RNI

29.   ARTE-RNI describes a Service Oriented Architecture implemented in a distributed network that can be viewed as a structure of different abstraction levels. At its most abstract level, there is a layer of support, a layer of services, a layer of applications and a layer of logical networks.

30.   Supporting architecture is the foundation of an IT infrastructure that interconnects distributed data and resources from different institutions. Each service supported by this architecture follows a standardized set of rules that facilitate further applications development.

31.   Services define basic functions like "database querying", "download/upload of files", etc. Services are used by applications to implement functionalities en an easier and standardized way. Applications are developed to meet specific groups of users with different relevances.

32.   Finally, logical networks allow different treatment for each goal set by ARTE-RNI, ensuring specialized care of each type of need that must be met by the system as a whole.