INF 5210 – Group 2

Project:

skolenettet.no

Mandatory delivery 1.

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1 – Group participants

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2 – Description of the Infrastructure

2.1 – The Internet portal "Skolenettet".

2.1.1 – The goal of the Infrastructure

A school should be a place for learning[1]. In order to do just that, technology can play an important roll. This projects first goal was to make users ready to take advantage, get familiar and to use new technologies. By using Skolenettet[2] users can get in contact with other users with potentially different area of interest, knowledge, experiences, language and cultural background. By doing this, the Internet portal Skolenettet will help users and spread their knowledge in Norway, the Nordic countries and other connected computer networks.

2.1.2 – Background and motivation

One of the tasks of the Læringssenteret[3] is to encourage development of new and innovative products that stimulate users to actively work with their knowledge. In short to get people to learn more. Based on experience, new products can in the future be developed with the right properties to reach this goal. What Læringssenteret is doing is based on the Norwegian Government's plans of action to develop digital ways of learning described in "Plan for utvikling av digitale læremidler 2001-2003"[4] and "IKT[5] i norsk utdanning 2000-2003"[6]. Therefore the Internet portal "Skolenettet"[7] was launched where results of this project would be presented. Skolenettet plays a central role in the Government's plan in the area of educational adapting[8, 9].

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[1] Jostein Osnes (2000), "Skulenettet – ein stad å lære", Skolenettet.no,
http://skolenettet.ls.no/imaker?id=17973&malgruppe=0&trinn=0&omr=1671&mal=nyhet, accessed 26.09.03.
[2] The School Net.
[3] Norwegian board of education.
[4] Plan for developing digital ways of learning 2001-2003.
[5] Internett og kommunikasjonsteknologi.
[6] Internet and communication technology in Norwegian education 2000-2003.
[7] Læringssenteret (2003), "– Skolenettet –", http://www.skolenettet.no, accessed 26.09.03.
[8] Innsatsområdet "Pedagogisk tilrettelegging"
[9] Utdannings- og forskningsdepartementet (2003), "Skolenettet analysert",
http://www.odin.dep.no/ufd/norsk/satsingsomraade/ikt/045071-990202/index-dok000-b-n-a.html, accessed 26.09.03.

By using Skolenettet, the goal is to deliver an Internet portal service aimed at schools from a primary school level to colleges. Here the schools should have easier access to the new services this new technology has brought with it and related challenges.

2.1.3 – Historical development of the Information Infrastructure

Skolenettet was launched on October 15 1996 by Nasjonalt læremiddelsenter, now Læringssenteret, as a result of the Governments plan of action "IT[10] i norsk utdanning, plan for 1996-1999"[11] developed by UFD[12], [13]. Their vision was to establish an Internet based service to Norwegian schools that should distribute educational information based on and controlled to be in line with the schools plan of learning. Skolenettet should anticipate in projects and give a wide specter of services to pupils, parents and other people who are involved with the pupils learning process.

Skolenettet has had cooperating partners since the beginning. Governmental offices, institutions and organizations with relevance to schools and education have played important parts in the project. Skolenettet has been an active participant in the organization European Schoolnet (EUN[14, 15]) since it was established in 1997.

Skolenettet changed from being a static information channel to a site with interactive services. Major new services where launched like discussion groups and bulletin boards in 1997 and the e-mail service "Skolepost"[16] in 1998. Bonds between the Nordic countries educational services where tied when other Nordic school networks started connecting to Skolenettet.

The ambition of project Skolenettet was good, but a good end result failed to come out of the Governments plan. One year later, in October 2000, Skolenettet reopened as a central tool in the new plan of action "IKT i norsk utdanning 2000-2003". Læringssenteret was still the organization behind Skolenettet and it was based on the same goals. New services, resources and arenas specially made for teamwork where to make Skolenettet a national center for education. Her users should find information and get feedback on different subjects, of high quality in terms of educational, linguistic and technically.

Today Skolenettet is one of eight Nordic school networks that make up the ODIN[17] school network. This network's main task is to bring schools closer together and stimulate cooperation between Nordic schools, teachers and pupils. In addition the EUN has grown to include educational departments and school networks from 25 European countries. EUN develop new services and supports teamwork between European schools, support to enhance teacher's professional development and distributing information and services with a European focus. Anticipating in the EUN has given Læringssenteret and UFD many valuable international contacts and the European Parliament[18]. They have also been able to compare them selves to other advanced schools in Europe. The use of Skolenettet has today been inserted into the schools curriculum and teachers training programs by UFD.

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[10] Norwegian: Informasjonsteknologi   English: Information Technology
[11] *Information technology in Norwegian education, plan for 1996-1999.*
[12] Norwegian: Utdannings og forskningsdepartementet English: Ministry of Education and Research
[13] Læringssenteret (2003), "Skolenettet.no", Læringssenteret, http://skolenettet.ls.no/skolenettet/data/f/1/49/30/3_802_0/Skolenettet-no.2003.pdf, accessed 26.09.03.
[14] In Norwegian: Det Europeiske skolenettet.
[15] European Schoolnet (2003), "The gateway to education in Europe", http://www.eun.org, accessed 26.09.03.
[16] School post, web based e-mail service.
[17] Nordic School Data Network.
[18] EU-kommisjonen

2.2 – Project users

2.2.1 – User groups

2.2.1.1 – Introduction
In the first quarter of 2003 the average number of page views where between 230 000 and 260 000 every school day. In average this means some 3 300 different users used Skolenettet every day.

2.2.1.2 – Primary user group
The most central part of all schools is to educate the pupils and other students. The Skolenettet's primary user group is pupils and students from a primary school level to a collage level and their parents and other guardians.

2.2.1.3 – Secondary user group
The secondary user group is everyone else who anticipates in the work of teaching the children. This user group consists of mainly teachers and other school personnel.

2.2.2 – Services, subsidiary functions and user properties

2.2.2.1 – Different start pages
The Skolenettet's user group is very large with various different needs. Due to this a special start pages has been developed for the pupils, school staff (including the teachers) and for parents and guardians. By doing this, a more user specific material can be presented to each group of user.

2.2.2.2 – Services and programs
From Skolenettet's front page you have access to three main services[19]: The Skolenettet as a startup page, as an arena for learning and a gateway to other sites on the Internet.

Skolenettet's user adapted pages has been split into three main ports in order to fill the users requirements: One for the children[20], one for school employees[21] and one for parents and guardians[22]. Each of these portals has their own sets of services and user possibilities.

As seen from the graphical appearance, the parents' and guardians' pages are the only ones who break with the graphical appearance of the general front page.

Since the reintroduction of Skolenettet some 46 new web services has been launched and some 10 000 quality checked hyperlinks are accessible though Skolenettet's many individually pages and services. The number of services launched before the year 2000 has not been unveiled to us. But it

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[19] Læringssenteret (2003), "Ny informasjonsbrosjyre om Skolenettet", http://skolenettet.ls.no/imaker?id=149298&malgruppe=0&trinn=0&omr=5&mal=nyhet, accessed 26.09.03.
[20] See chapter "4.2.2 – Children's front page" for graphical appearance.
[21] See chapter "4.2.3 – School employees' front page" for graphical appearance.
[22] See chapter "4.2.4 – Parents' and guardians' front page" for graphical appearance.

has been unveiled that big changes are on its way. The main reason for this will be discussed later in chapter "2.2.2.5 – Defining a user group". It will therefore be interesting to pay attention to how the site will change over the next months. In this process it will be important to develop and set clear long term guidelines so that suppliers of information and services can work with one standard for how their work should be now and in the future.

2.2.2.3 – Different language versions

All Skolenettet's main pages are available in Norwegian and New-Norwegian. Other documents are being translated between Norwegian and New-Norwegian, and high priority documents also into English. Læringssenteret hides behind a tight budget for why just a few documents are translated. None of the information needed for this document was available from Skolenettet in English.

The three main services of Skolenettet requires users to log in, "Skolepost", "Skolesekk"[23] and "Skolestue"[24] are available in Norwegian, New-Norwegian, Sámi, English and Finnish. Bullet boards are available in Norwegian, New-Norwegian, English, German and French.

2.2.2.4 – Answering services and forums

2.2.2.4.1 – Introduction

Skolenettet has a number of answering services and forums available for it's users. These are aimed at different courses and areas of interest. Here users can send questions and get reply from qualified personnel. All questions and answers are placed on Skolenettet's web pages so that other people also can take advantage of this information. All user groups have access to the services. But certain services have been placed in areas aimed at specific user groups for easier access. Services aimed at for instance adults are in this way placed higher in the hierarchy of web pages and easier to access from the front pages.

2.2.2.4.2 – Answering services for children

There are a number of services available like "Elines dagbok fra Svalbard"[25], "Global skole: IKT i skolen"[26], "Matskolen"[27] and "Norsk TENK lærersone"[28]. There are in addition services directed at the specific subjects nature and environment, and social services.

2.2.2.4.3 – Answering services for adults

Ethics and law: Juridical answering service, answering service from the schools responsible for information and communications, linguistic minorities, specially adapted ways of learning and THINK zone for teaching.

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[23] School backpack. A storage area where users can store documents online.
[24] School workroom. Very much like School backpack but with restricted user access, useful in team works.
[25] Elines journal from Svalbard.
[26] Global school: Information and communication technology in the schools.
[27] The school of food.
[28] THINK Norwegian zone for learning.

2.2.2.5 – Defining a user group

Skolenettet has a very wide user group. This makes it difficult to develop services directed at every user. That is why different places have been developed for children, school personnel and parents and guardians. A large effort is placed in developing services for each of these user groups. But as we have seen, many of these pages have a very similar appearance. Users therefore have problems identifying their "right" place to be. Reports have also shown that users lose track of where they are on the hierarchy of web pages and feel that the right information is hard to find.

This is a problem related to Skolenettet's lack of practical information infrastructure and navigation. One reason behind this is the lack of knowledge about what kind of user who is using their services. This makes it difficult to adapt services to the right user group. Some 71,7 % of Skolenettet's users are using the main Internet port and not their user adapted pages when using Skolenettet. As a result general services have been placed on this site and not user adapted services.

The user groups who are hardest affected by a less than good service are the children. When something isn't the way they want it, they are more likely to look for new Internet ports than the adult user groups. A thrall research hasn't been done as of today, but printer logs from Skolenettet's servers shows more users are using Skolenettet after normal lecture time when the children have left the school. This is an indication that the main user group of Skolenettet, in terms of actual use per person, actually is users from the second user group: the teachers. This is not a good sign for a network developed for the children. After all, for every teacher there are about 25 children in a typical school. This might be the sign that the web site hasn't been adapted to the needs of the children. See chapter "2.4 – Organizational framework" for feedback from users.

In addition Skolenettet has gone thru several small and one big generation, which have affected the structure of the web site. This could break down the hierarchy of web pages from a solid structure, to a big mess from the user's point of view. For the web site's user groups this would be of concern, since the users interface keep on evolving. When presented with a new graphical interface or logical changes, the user has to learn the site once again in order to continue using his or her traditional services. By doing all these changes, users may feel a bite uncomfortable about the site and therefore stop using it. Children are not known to be patient. This could very well be one of the most important reasons why so relatively few children are using the Internet portal.

These are all point the consultant firm Metamatrix made remarks about when analyzing Skolenettet[29]. This report was delivered earlier this year in front of an announced restructuring for what could be a new, third generation of Skolenettet.

2.3 – Technical structure

2.3.1 – Information infrastructure

On today's web servers it is normal to combine the use of different structures to organize data in an information infrastructure. The three main lines are sequential, hieratical and network architecture.

Sequential – where information is tied together in lines, one page after one other, often organized alphabetically or by a number.

[29] Metamatrix (2003), "Problemnotat om Skolenettet", Utdannings og forskningsdepartementet, http://www.odin.dep.no/archive/ufdvedlegg/01/04/Probl037.pdf, accessed 26.09.03.
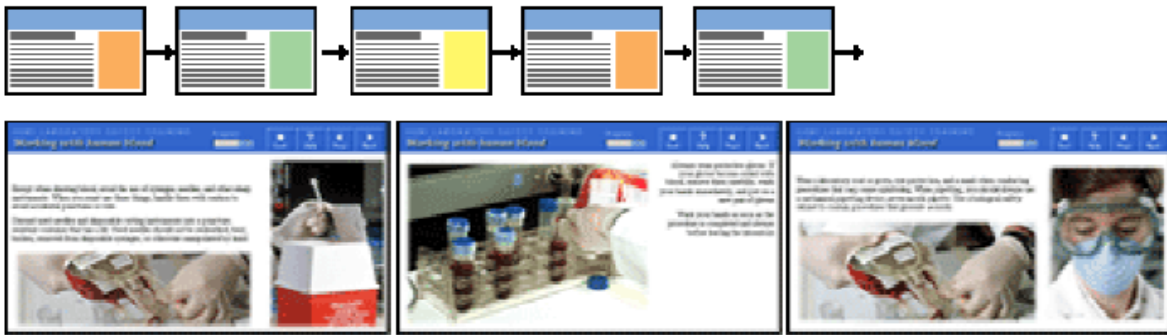
Figure 1 – Sequential[30]

Hieratical – documents are tied together in a tree like structure
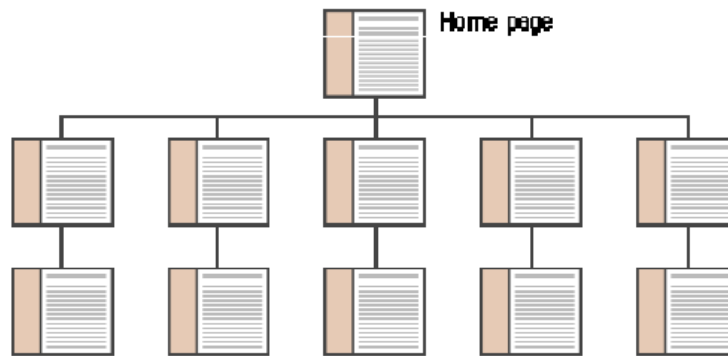
Figure 2 – Hieratical[31]
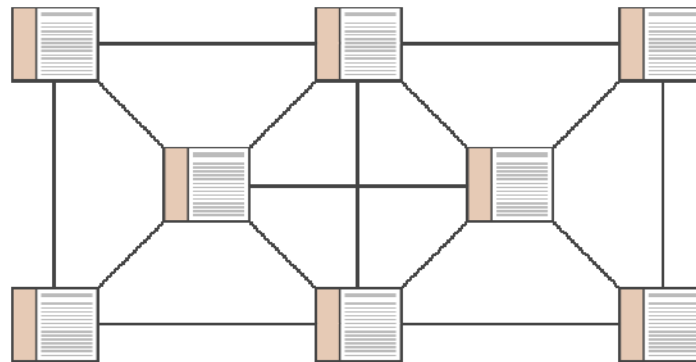
Network – documents are tied together in a web.

Figure 3 – Network architecture[32]

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[30] From Metamatrix (2003)[29], page 16. Originally from Patrick J. Lynch and Sarah Horton (2002), "Web Style Guide", http://www.webstyleguide.com.

[31] From Metamatrix (2003)[29], page 16. Originally from Patrick J. Lynch and Sarah Horton (2002), "Web Style Guide", http://www.webstyleguide.com.

[32] From Metamatrix (2003)[29], page 17. Originally from Patrick J. Lynch and Sarah Horton (2002), "Web Style Guide", http://www.webstyleguide.com.

It's normal to mix architectures. The most common architecture combination is to combine the hieratical architecture with one of the two others. Skolenettet combines all three architectures in its system. This mix of structures can for untrained eyes look like no structure at all. This lack of structure can be a problem when updating the Internet portal and it's web pages.

2.3.2 – Physical and technical structure

Skolenettet is being run on a server park consisting of seven servers with different tasks. All servers use a version of the Linux operation system. To publish data, to make an information infrastructure and for handling of user access rights the tool iMaker is used. The publishing system runs on two identical servers who shear equally on the workflow. Data is stored partly on the servers as a database, and partly on a NFS[33] based server as "flat files". We are working on what this actually means: eider the files lie with no structure (in stead of in a hierarchy), or as files based on relation-theory and the database is of the object-oriented sort. The services Skolesekk and Skolestue run directly on these servers. Skolepost consists of three parts: a web client (the publishing system), IMAP[34] and SMTP[35]. The IMAP- and SMTP-modules runs on their own servers and can access the local e-mail server. The user database for Skolepost, Skolesekk and Skolestue are placed on a dedicated LDAP[36]-server. The chat service on Skolestue are rune in it's own server. Publishing and software based services are performed thru an interface displayed in a web browser.

Chat servers for Skolestue

2 loadshearing publishing servers

E-mail to Skolepost

Database server   NFS server   LDAP server
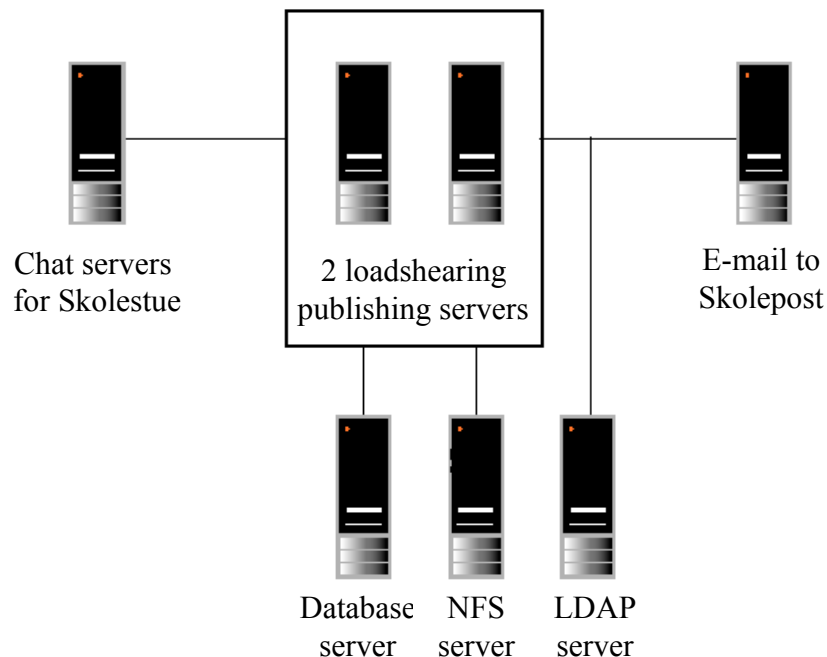
Figure 4 – Logical overview of the server network[37]

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[33] Network File System – A Unix/Linux file system where files can be shared within a network.
[34] Internet Message Access Protocol – Makes it possible to access e-mail without downloading messages to the user's local machine.
[35] Simple Mail Transfer Protocol – To transfer e-mail between servers.
[36] Lightweight Directory Access Protocol – Database system with addresses to Internet sites in order to gain faster access by storing the address of other web sites.
[37] From Læringssenteret (2003)[13], page 18.

A problem with the chosen software tools (iMaker) is that they are not standardized. This makes the system difficult to operate if these specific tools no longer could be used. A convention to another system and standards could lead to larger expenses than with a standardized system as a result.

2.3.3 – Defined standards and system properties

Skolenettet was a pioneering project when it started back in 1996. Today some 25 external web based services are based on and physically connected Skolenettet's technical platform. By shearing technical platform, Skolenettet has gain access to external resources with a minimum of resources needed. The external service providers have in return received a developed and working platform to base their publications and work upon.

Metadata is normal to use in order to tag additional information to a document. This is often information not displayed to the users as a part of the displayed document, in our case the web pages. In stead, it lies "behind the scene" to help search engines to locate specific or related documents.

All contents of Skolenettet are marked with metadata. This way element can be organized and retrieved in an efficient way from the computer systems point of view. The metadata is based on the Dublin Core standard. Some additional metadata are based on standards from EUN. This is a de facto standard for labeling of educational contents used on the Internet. This metadata is used to give more detailed and relevant markings for use for schools and learning.

One thing is to locate a web page. This task is very different from displaying the information in a way the user wants. There has been a lot of criticism about how web pages are presented after Skolenettet's search engine has found them. The ability to display information in a user friendly way is a critical property to a search engine system. Children are especially known for showing little tolerance at this point. Since children are a major user group for Skolenettet, this is a serious problem. Metadata is also used to determent a user's user group. Since there are conflicts surrounding the use of metadata, many users feel that the "right" information is difficult to locate. Often information is displayed aimed at other user groups.

The Skolenettet Internet portal is a dynamic and living site. It has always been based on the latest HTML standards without using plug-ins or special client software. This has made the site available for all users without concerns about the user's software and hardware. The only requirement is an updated web browser. We regard this as a very valuable property of the Skolenettet Internet port.

Experiences from Skolenettet and other Norwegian sites, has led to the establishment of the eStandard[38] project in Norway. This is a part of UFD's plan to establish a National net for learning[39] and the educational portal utdanning.no[40], where all national sites should be built upon the same technical platform. From this site users should gain access to Internet sites dedicated to the user's special needs. Therefore Skolenettet is connected to the utdanning.no web portal. Results from this project are posted as the eStandard.

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[38] eStandardprosjektet (2003), "Bruk av standarder i nasjonalt læringsnett", http://www.estandard.no, accessed 26.09.03.
[39] Nasjonalt læreingsnett (NLN)
[40] Utdannings- og forskningsdepartementet (2003), "Utdanning.no – alt på ett sted", http://www.utdanning.no, accessed 26.09.03.

2.4 – Organizational framework

A big advantage of using a common publishing system and technical platform is the possibility for users to developing and doing maintenance on their services directly in the site without involving other personnel and making changes to the main service. To the Skolenettet system there are many sub divisions, each with their own area of responsibility. How the job is done is up to the division. This opens up the possibility of using hired consultants when this is needed. This possibility is used: Skolenettet has relations to several external consultants. The overall responsibility for Skolenettet lies with Læringssenteret. It's their job to see to it that each sub division gets their jobs done in the right way. Læringssenteret is in tern responsible for doing what the UFD wants it to do.

A main group at Læringssenteret holds the responsibility over Skolenettet. Their tasks are to:

- Lead the development of new concepts, structure, design and functionality.
- Support the editor and end users.
- Provide guidance.
- Supply end users with information.
- Development of material for guidance.
- Run the divisions who make front pages, bulletin boards, newsletter service and global resources.
- Coordinate the sub divisions by:
  - Setting guidelines and quality standards.
  - Transferring contents from the sub divisions to the front pages.
  - Arrange training and give user support in the iMaker publishing system.
  - Distribute graphics and illustrations.

As of April 2003 the main group consists of four people filling 3,5 full time jobs. There are about 80 active editors with special tasks and fields of interest within their courses. Each year Læringssenteret arranges a course where the editors update their knowledge, get training and gets the possibility of meeting other editors and exchange experiences.

Technical drifting is also done at Læringssenteret. This includes service to the network, telecommunication lines, servers, operating systems and security issues like taking backups. Technical drifting is employed as 1,75 full time jobs. External consultants are used in order to do other technical tasks like installations, configurations and system surveillance. Læringssenteret has their own deals with suppliers of software, hardware and network components.

Funding for Læringssenteret is given by UFD. The strong connection with a political institution is a problem for Skolenettet. The UFD's strong political connection makes it very affected by the political "turbulence". Long-term plans can't be developed, which makes it difficult to make plans and develop special areas of interest. This has made it unclear to the involved parties what they should work with and how they should work together as a team towards a common goal. Because of the unstable political environment, short time solutions are often chosen instead of the long term. This way short-term benefits can be made. But as we have seen, this has also lead to a cloudy information structure and problems of getting the "right" information to the end users. A project that deals with this problem has started and will hopefully result in the use of more long-term solutions. Their work will take advantage of the results and other information revealed by the Metamatrix rapport. The connection to the Internet site "utdanning.no" is also regarded as unclear.

We have been in contact with the IKT-responsible at a school in Oslo. He confirmed that the close connection with the Government was THE big disadvantage with Skolenettet. The children and school personnel didn't like to use Skolenettet since it was old and lacked many features other

private and Internet based networks provides. The only reason why they used Skolenettet was because school employees where committed to use it in their in-service training[41]. We where told that before the user groups will use the network at their own will, one thing must be dealt with: To convert the existing, big, bulky and slowly evolving system into a modern fast adopting network where new technologies and possibilities are being taken advantage of when they are introduced.

3 – Analysis

3.1 – Why Skolenettet is an Information Infrastructure

3.1.1 – Definition

The term "infrastructure" is defined in Webster's Dictionary as:

> "A *substructure or underlying foundation; esp., the basic installations and facilities on which the continuance and growth of a community, state, etc. depend as roads, schools, power plants, transportation and communication system, etc.*" (Guralnik 1970)[42].

As a comparison we would like to quote the meaning of the word taken from the Oxford English Dictionary[43]:

> "*A collective term for the subordinate parts of an undertaking; substructure, foundation; spec. the permanent installations forming a basis for military operations, as airfields, naval bases, training establishments, etc*".

While both give us the sense of collectivity and subordinate parts, the former would be a more fruitful definition in deciding whether an entity is an infrastructure.

In this section, it will be shown that Skolenettet is an Information Infrastructure. Our two keywords are Information and Infrastructure. However, we consider that it is sufficient to elaborate the later ("Infrastructure") since we can take it for granted that this all project is all about information.

3.1.2 – Aspects of an Infrastructure:

1. It has a supporting and enabling function, *in the sense that* it is intended to open up a field of new activities, not just to improve or automate something that already exists.

2. It is shared by a larger community, *in the sense* that it is the same single object used by all the members of community (although it may appear differently).

3. It has an openness characteristic, *in the sense* that there are no limits to the number of users, stakeholders, and vendors involved, nodes in the network and other technological components, application areas, network operators, and so on. *In other words*, one cannot

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[41] Etterutdannelse.
[42] From Claudio U. Ciborra and Associates (2000), "From Control to Drift", Oxford University Press. ISBN: 0198297343, page 56.
[43] Oxford English Dictionary (2003), "Infrastructure", http://dictionary.oed.com/cgi/entry/00116565?single= 1&query_type=word&queryword=infrastructure&edition=2e&first=1&max_to_show=10, accessed 26.09.03.

draw a strict border saying that there is one infrastructure for what is on one side of the border and others for the other side and that these infrastructures are independent.

4. It is standardized, in the sense that it employs one or more standards to make coordination and control possible.

5. It is socio-technical, in the sense that it has a social and technical scope.

6. It is heterogeneous, in the sense that it is a combination of many different actors, interests and technical platforms.

7. It is installed-base, in the sense that it is not built from scratch, but it is built on top of previous system.

3.1.3 – Conclusion

Judging from the definition above we conclude that Skolenettet is an Information Infrastructure for the following reasons:

- It has ***supporting*** and ***enabling*** functions, in the sense that, it makes all the existing "functions" (communicating, exchanging information between all actors connected to children's education) easier and reach a wider scope. Since it is easier to communicate and exchange information, then it enables them to plan activities, to gain resources, to communicate ideas, in a different way than before. Apart from the easier and more global reaching way of doing things, we did not find an intention to open up a field of new activities.

- It is ***shared*** by a large community. The communities sharing it are schools as institutions, students, teachers, and parents. The size of the communities is beyond Norway's national boundaries since Skolenettet is connected to European Schoolnets. Although, it can appear differently since Skolenettet has got different *views* to different groups of users.

- It is ***open***. As mentioned in the description of "openness" above, Skolenettet is open in the sense that there are no limit of the numbers of users, stakeholders, and vendors involved. When more schools or Schoolnets get connected, it means that there are more users, stakeholders, and vendors involved. Theoretically, there are no limits of schools that could get connected. The users (user groups) are students, school personnel and parents and guardians. The stakeholder is the Ministry of Education and Research (in the case of Norway). For other cases, i.e. in other European Schoolnets, it can be any party who initiates and invests on the establishment of Schoolnet. In Norway the vendor or network operator is *Læringssenteret*.

  It is also open in the sense of technological components, which are using the Internet standards. So, technically, everyone can access Skolenettet, at least as a general public user group, as long as they conform to the Internet technology standard.

- It has an ***installed-base***. Skolenettet is not created from scratch. The present Skolenettet is a second-generation network built upon the old system.

- It is ***standardized***. It is built upon Internet and European Schoolnet standards.

3.2.1.5 – OPP

The obligatory passage point, broadly referring to a situation that has to occur in order for all the actors to satisfy the interests that have been attributed to them by the focal actor. The focal actor defines the OPP through which the other actors must pass through and by which the focal actor becomes indispensable.

3.2.1.6 – Interessement

The second moment of translation which involves a process of convincing other actors to accept definition of the focal actor (Callon, 1986).

3.2.1.7 – Enrollment

The moment that another actor accepts the interests defined by the focal actor.

3.2.1.8 – Inscription and delegates

- A process of creating technical artifacts that would ensure the protection of an actor's interests (Latour, 1992)[45].
- They are actors who stand in and speak for a particular viewpoints which have been inscribed in them

3.2.1.9 – Irreversibility

The degree to which it is subsequently impossible to return to a point where alternative possibilities exist (Walsham, 1997)[46].

3.2.1.10 – Black box

A frozen network element often with properties of irreversibility.

3.2.2 – The analysis

In the early phase, there was the Government – the primary actor – Nasjonalt Læremiddelsenter (now Læringssenteret) – another actor that played the operator role. In terms of Actor-Network Theory, these are the initiators or *initial actors* of the Skolenettet project. Their interests are to carry out the Government's action plan started with "IT i norsk utdanningsplan for 1996-1999", to make a uniform national education system, and to establish an Internet based service for Norwegian schools

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[45] Latour, B. (1992), "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts.", Bijker,W & Law, J. (Eds.) 1992. Shaping Technology / Building Society: Studies in Sociotechnical Change. Cambridge: MIT, ISBN 0262023385

[46] Walsham, G. (1997), "Actor-Network Theory and IS Research: Current Status and Future Prospects", Lee, A.S; Liebenau, J.; and DeGross, J.I. Information Systems and Qualitative Research Chapman & Hall, London, ISBN 0412823608

which distributes educational information that is in line with the school's plan of learning. With respect to change technology, they also want to give access to follow the new educational system. And eventually they expect to achieve more freedom on educational system by being independent of time and space.

In order to achieve this interest or vision, the initial actors invited the Governmental offices, institutions and organizations with relevance to schools and education. In the terms of ANT these *actors* have performed *an actor-network* since each of the actors has its own needs or interests to the existence Skolenettet.

This new actor-network gives rise to an awareness that they can increase in size that leads to a more heterogeneous network. The network eventually includes the targeted *end-users* that are: school students, parents, teachers and other school personnel. The end-users may at first not obviously be seen as actors since according to the definitions above actors must "bend the space around them selves" or influence the system. However, this leads to a new property to be entitled to Skolenettet: it has to anticipate in advance and give a wide specter of services to the targeted end users. This property gives more power to end-users that enable them to influence the system. Then they can be considered *actors* as well.

This is the example of the *translation* process. It starts with a *problematization* when the actors realize the new requirements of the system. Sometimes all the actors, like the requirement, so easily accept the problem so that it can skip the *interestsement* and just step directly to *enrollment* that is a moment when another actor accepts the interest of focal actor. We may say that here the focal actor was the Government.

Actor-Network Theory equips the analyst to perceive possible conflicts of interest among actors. According the user statistics, the system to which it was focused is not in real effect. The system has shown to be not clear on where information should be found in an easy way. This is one reason why school personnel are using Skolenettet more than the children and students.

We may consider this as a conflict of interest. Actors involved in this conflict are system designer who design the appearance of the system and children and students. They resolve this by simplifying the contents of Skolenettet so that anybody can easily get the information they want. The system designers should have more contact with their user groups in order to get more information about what the users want or what way users want to interact with Skolenettet. If they stumbled on something that needs more authority to decide, Government as the prime initiator would likely be the pushing force with its political authority.

The "dialectical" processes above are an illustration of the *dialectical process of inscription and translation* in the Skolenettet as an actor-network. Each actor is thriving to put forward their interest so that it becomes the interest of other actors and eventually is implemented in Skolenettet. So far, the services that were born by this dialectical processes are: Skolenettet as a dynamic educational information channel with over 50 different online services which gives access to all services through a single web page system.

After being in operation for some times, there has been a dynamic in the actors who are involved. More actors enter the playground; some actors reduce their influence while some increase it. New actors that we can identify are the other European school networks. This increases the size of Skolenettet and the heterogeneity as well.

The facts the there are more users involve increase the necessity of improving the quality of services. One obvious thing is the need to use local languages as well as understanding the local culture and working across different time zones.

New actors did not play as essential as the Government as the old actor. Government once again played an important role by reopening the Skolenettet as a central tool in the new "IKT i norsk utdanning 2000-2003" action plan.

Again the incoming of a new actor with its own interest will change the dynamic of the system with the inscription-translation mechanisms. This time the results are the multilingual services. The "second generation" of Skolenettet shows a change from being a static information channel to a site with interactive services, discussion groups, bulletin boards, and Skolepost email service.

The ANT also equips us with notions of *irreversibility*. The changes we previously described are mostly irreversible. After being a site with interactive services, it is impossible to return into being a static information channel, since it has changed the way end-users use Skolenettet. Now the end users have some of the power to shape Skolenettet.

But some actors still are more powerful than others. For example, the Government still holds the key to the existence of the system. If the Government decides to cut funding to the Skolenettet system, this system could cease to exist.

4 – Illustrations

4.1 – Logical overview of involved parties at Skolenettet.
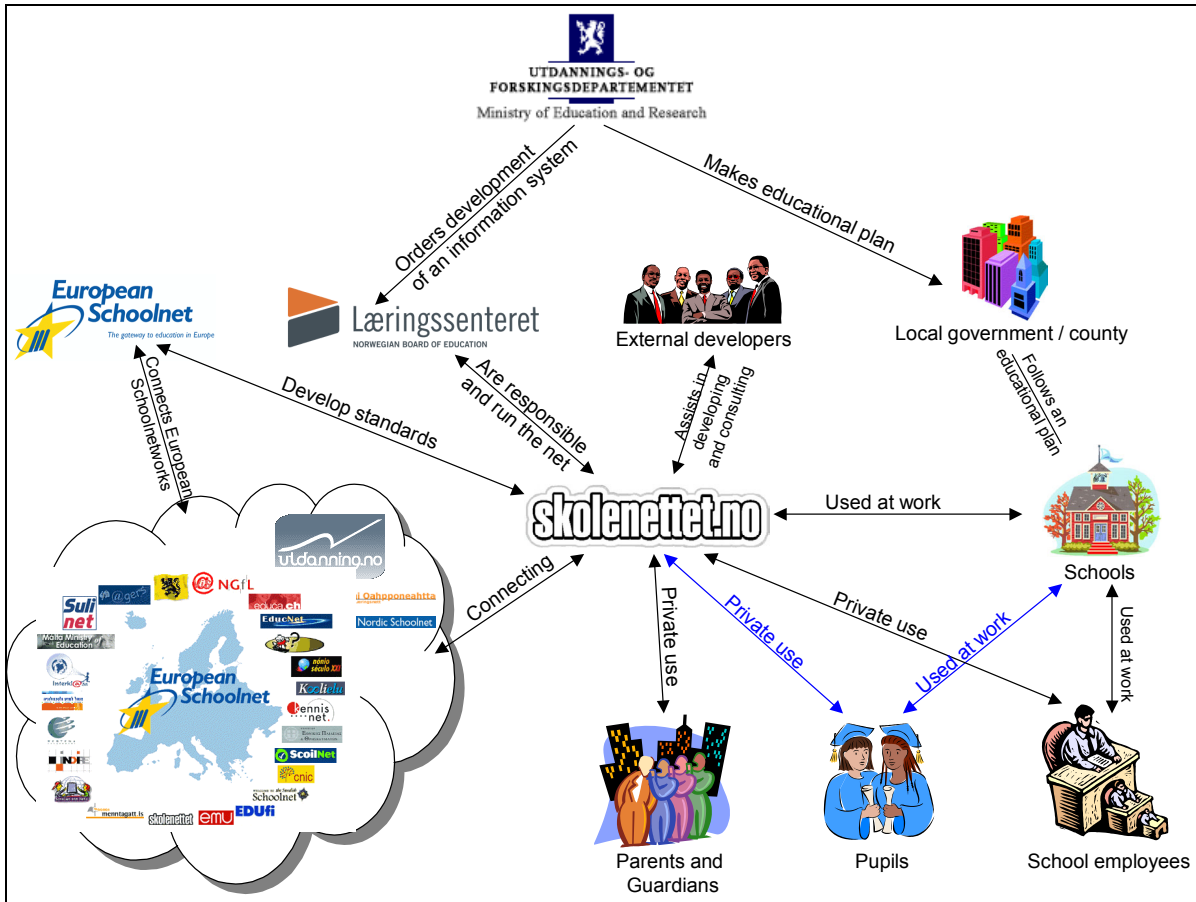
Figure 5 – Logical overview of parties

4.2 – Internet front pages

4.2.1 – General front page

Figure 6 – General front page[47].

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[47] Læringssenteret (2003), ”– Skolenettet –”, http://skolenettet.ls.no/imaker?id=3&omr=0&mal=forside, accessed 26.09.03

skolenettet.no

Group 2

4.2.2 – Children's front page

Figure 7 – Children's front page[48].

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[48] Læringssenteret (2003), "– Skolenettet –",
http://skolenettet.ls.no/imaker?id=6&malgruppe=2&trinn=0&omr=0&mal=forside, accessed 26.09.03.

4.2.3 – School employees' front page

Figure 8 – School employees' front page[49].

[49] Læringssenteret (2003), "– Skolenettet –",
http://skolenettet.ls.no/imaker?id=5&malgruppe=4&trinn=0&omr=0&mal=forside, accessed 26.09.03.

4.2.4 – Parents' and guardians' front page

Figure 9 – Parents and guardians' front page[50]

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[50] Fagutvalget på barneskolen (2003), "Start – Foreldrenett", http://www.foreldrenettet.no/, accessed 26.09.03.

4.3 – Personnel structure in the organization
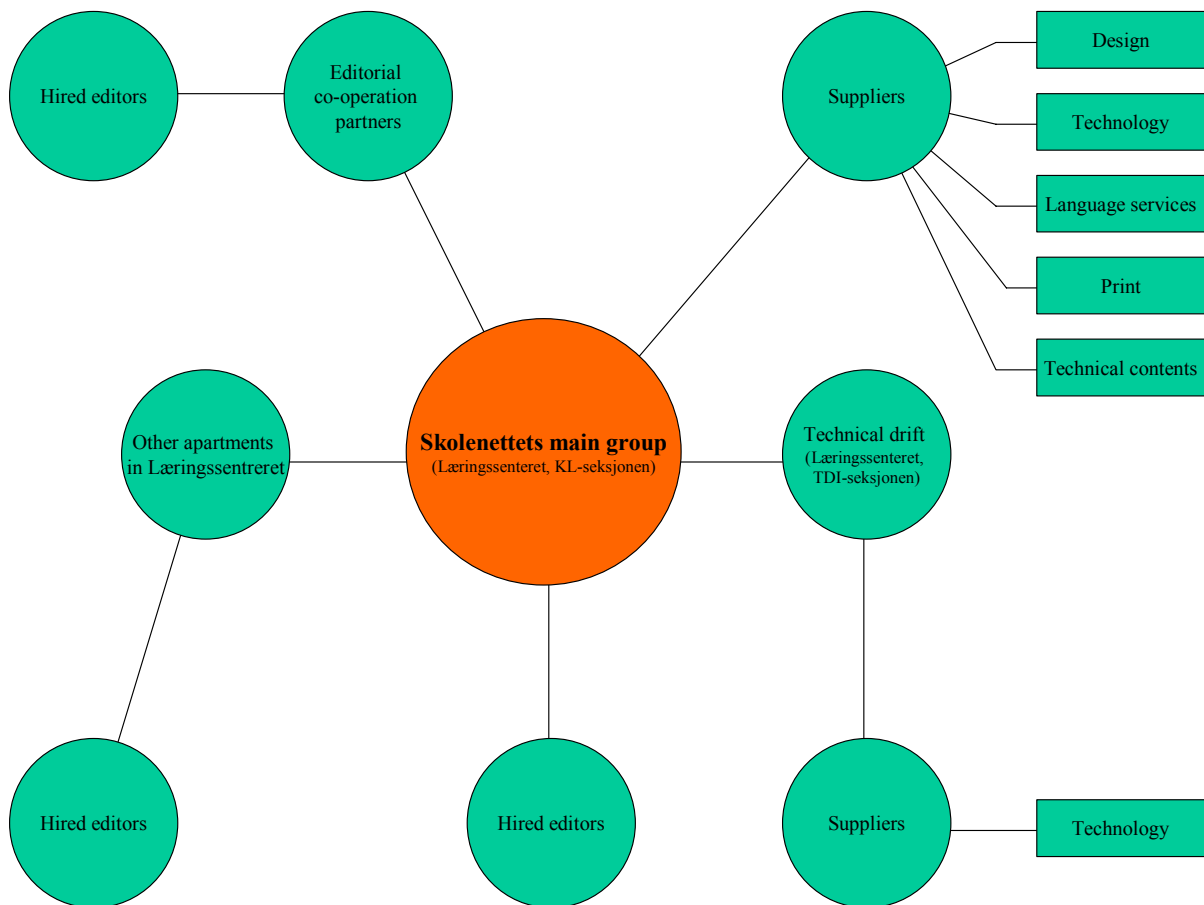
Figure 10 – Personnel structure[51]

5 – References

5.1 – Why footnotes

This document is based on facts and impressions made by printed material, web pages and interviews. We have decided to list a reference only once in order to avoid setting of numerous references on a large number of sentences.

In this document we have used footnotes frequently. This is because of many names and phrases have been translated into English. References to web pages and other documents have also been placed as footnotes in order to avoid two reference systems with the possibility of loosing overall view of the documents.

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[51] From Læringssenteret (2003)[13], page 17.

5.2 – Summary of references in footnotes

1   **Jostein Osnes (2000)**, "Skulenettet – ein stad å lære", Skolenettet.no, http://skolenettet.ls.no/imaker?id=17973&malgruppe=0&trinn=0&omr=1671&mal=nyhet, accessed 26.09.03.

7   **Læringssenteret (2003)**, "– Skolenettet –", http://www.skolenettet.no, accessed 26.09.03.

9   **Utdannings- og forskningsdepartementet (2003)**, "Skolenettet analysert", http://www.odin.dep.no/ufd/norsk/satsingsomraade/ikt/045071-990202/index-dok000-b-n-a.html, accessed 26.09.03.

13   **Læringssenteret (2003)**, "Skolenettet.no", Læringssenteret, http://skolenettet.ls.no/skolenettet/data/f/1/49/30/3_802_0/Skolenettet-no.2003.pdf, accessed 06.09.03.

15   **European Schoolnet (2003)**, "The gateway to education in Europe", http://www.eun.org, accessed 06.09.03.

19   **Læringssenteret (2003)**, "Ny informasjonsbrosjyre om Skolenettet", http://skolenettet.ls.no/imaker?id=149298&malgruppe=0&trinn=0&omr=5&mal=nyhet, accessed 26.09.03.

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42   **Claudio U. Ciborra and Associates (2000)**, "From Control to Drift", Oxford University Press. ISBN: 0198297343

43   **Oxford English Dictionary (2003)**, "Infrastructure", http://dictionary.oed.com/cgi/entry/00116565?single=1&query_type=word&queryword=infrastructure&edition=2e&first=1&max_to_show=10, accessed 26.09.03.

44   **Callon, Michel (1986)**, "Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay.", J.Law (ed.) Power, Action and Belief. London press, ISBN 0710208022

45   **Latour, B. (1992)**, "Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts.", Bijker,W & Law, J. (Eds.) 1992. Shaping Technology / Building Society: Studies in Sociotechnical Change. Cambridge: MIT, ISBN 0262023385

46   **Walsham, G. (1997)**, "Actor-Network Theory and IS Research: Current Status and Future Prospects", Lee, A.S; Liebenau, J.; and DeGross, J.I. Information Systems and Qualitative Research Chapman & Hall, London, ISBN 0412823608

47 **Læringssenteret (2003)**, ”– Skolenettet –”,
http://skolenettet.ls.no/imaker?id=3&omr=0&mal=forside, accessed 26.09.03

48 **Læringssenteret (2003)**, ”– Skolenettet –”,
http://skolenettet.ls.no/imaker?id=6&malgruppe=2&trinn=0&omr=0&mal=forside, accessed
26.09.03.

49 **Læringssenteret (2003)**, ”– Skolenettet –”,
http://skolenettet.ls.no/imaker?id=5&malgruppe=4&trinn=0&omr=0&mal=forside, accessed
26.09.03.

50 **Fagutvalget på barneskolen (2003)**, ”Start – Foreldrenett”, http://www.foreldrenettet.no/,
accessed 26.09.03.