

The Making of MoRENet

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Abstract

Although MoRENet has been defined in 2002 and included in the National ICT Policy Implementation Strategy of Mozambique as one of the priority projects in the area of education, only in 2005 the pilot phase of this network started covering some institutions in Maputo, and it took until 2014 before MoRENet started to provide national services. The reasons for this long gestation period and how they were dealt with can be lessons for other emerging National Research and Education Networks (NRENs). The discussion of MoRENet initiative started during the formulation of the ICT Policy Implementation Strategy in 2001, and it has been defined as a project with the aim of providing affordable Internet services for the Higher Education and Research sector in Mozambique. The first attempt to build a national network for research and higher education and implement the envisaged services in Mozambique did not take off for various reasons, the most important being that the initiative was not well embedded within the stakeholders and also because there was no sound financial plan. NRENs are often presented as a technical solution to provide affordable Internet services, with the higher education and research sector as sole beneficiary. It is wiser to address society priorities related to the Networked Readiness of the country when trying to prove the case of the NREN. In 2011 the MoRENet initiative got back to the momentum it had in 2005, this time as a joint project of the Ministry of Science and Technology and the Ministry of Education and Culture. At the end of 2012 a financial plan was presented that forecast that, with initial funding from the World Bank, through the Mozambique eGovernment and Communication Infrastructure Project (MEGCIP), MoRENet would be financial sustainable in 2016. Since 2014 MoRENet is providing services and in 2015 has reached national coverage.

Keywords

NREN, MoRENet, Business Model, Research and Education, Connectivity, Internet Services.

1. Establishment of MoRENet (2000-2005)

The Mozambique Research and Education Network (MoRENet) is perhaps one of the oldest National Research and Education Network (NREN) in sub-Saharan Africa: it has been defined in the Mozambique ICT Policy Implementation Strategy approved by the Council of Ministers of the Government of Mozambique in 2002 (Council of Ministers, 2002) and its

pilot phase was established in 2005 covering 12 institutions in Maputo, and together with the UbuntuNet Alliance can celebrate its 10th anniversary this year.

In 2005 the Higher Education and Research domain in Mozambique were under different government departments, the Ministry of Education and Culture and the Ministry of Science and Technology respectively, with challenges in terms of collaboration and knowledge exchange between institutions. The higher education and research institutions were also facing difficulties in accessing international data communications resources, and some institutions were accessing the Internet through VSAT with high bandwidth costs. There was also some institutional challenges in implementing the strategic ICT vision defined in 2000 at the national ICT Policy (Council of Ministers, 2000), and operationalized in 2002 through the ICT Policy Implementation Strategy (Council of Ministers, 2002) , as well as the lack of strategic vision in adopting ICT at the institutional level.

It was in this environment that the Ministry of Science and Technology took up its responsibilities and established MoRENet in 2005. The objective of MoRENet was to integrate the national research and academic institutions into one national broadband network and to offer high quality data communication services for the participating institutions. The MoRENet strategy and service portfolio was presented, there was a proposal for the network architecture and there was an implementation plan (divided into three stages) and a governance model.

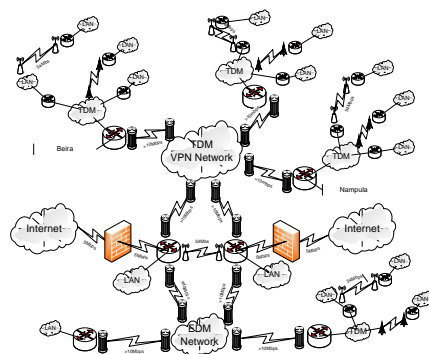


Figure 1 MoRENet Network Architecture (2006)

In short all the ingredients of a professional business model were in place to enable a successful launch of MoRENet operations in the 2006 – 2007 time frame. In reality the process came to a stand still shortly after the presentation of the business model. What happened?

2. The dark period of MoRENet (2006 – 2010)

As is often the case there is no single cause for this fall back, but more a combination of events and circumstances. The most important in the case of MoRENet are the following:

1. The approval of the ICT Policy Implementation Strategy in 2002 by the Government of Mozambique was followed by the challenge of establishing new government structures to coordinate and manage the implementation of this strategy (Council of Ministers, 2002) . The ICT Policy Implementation Technical Unit (UTICT) has been establishing for this purpose but it focused in eGovernment-related priority projects

- and the education-related priority projects were left to the specific line ministries, Ministry of Education and Ministry of Higher Education Science and Technology.
2. With the creation of the Ministry of Science and Technology in 2005 the government responsibility over the academic (research and education) and ICT sectors were spread out over two ministries, namely “Science and Technology” and “Education and Culture”. In any political system this will lead to political and bureaucratic challenges necessary to coordinate and lead the implementation of a transversal initiative such as the MoRENet, dealing with technology aspects but also with research and education processes and systems. The priority of the Ministry of Education and Culture in this period was focussed on improving primary education and secondary to overcome the huge illiteracy rate in Mozambique, and on reforming the Higher Education sector.
 3. The MoRENet initiative had been spread out over the Mozambican academic community as a warm blanket with the prospect that everything would be better if the plans were to be implemented, but without a sense of ownership by the academic community. As with the Higher Education sector within the Ministry of Education and Culture the MoRENet initiative had to compete with other challenges that often had a higher priority than a national data communication network for Higher Education and Research¹.
 4. The Government of Mozambique has not secured funding for all the priority projects that were part of the ICT Policy Implementation Strategy, including MoRENet.
 5. In this period the telecom market in Mozambique was dominated by the national telecom operator, TDM, without any competition from commercial telecom operators for broadband services (Council of Ministers, 2007). Mozambique is geographically a large country (more than 3000 km from North to South) with the economic, technological (concentration of telecommunications operators and ISPs) and political decision centres in Maputo, the capital city. Without affordable bandwidth to academic Points of Presence in the provincial capitals and districts it was practically impossible to create the physical national MoRENet network.

In 2007 and the following years some MoRENet infrastructure, as well as a radio linked network, was installed in Maputo to interconnect 12 institutions using a TDM backbone, but the national network organisation (MoRNet institutionalisation) that was to provide advanced services for its member did not materialise.

There are several lessons learned from this unfortunate start of MoRENet. First of all, it was deadly that the member constituency was not involved from the beginning. As a result there was no sense of ownership of the project by the leadership of higher education and research institutions in Mozambique. A consequence of the lack of ownership was further that there wasn't a strong leader to take over from the beneficiary institutions and that was left to the Ministry of Science and Technology. Second, there was no sound financial plan, in terms of expenditures and revenues, to support the MoRENet business model. The prospect that the connectivity tariffs would come down if MoRENet became operational was in itself a valid assumption, but it should have been validated with a sound financial plan. Third the government support was missing. Having two ministries involved in the process was in itself

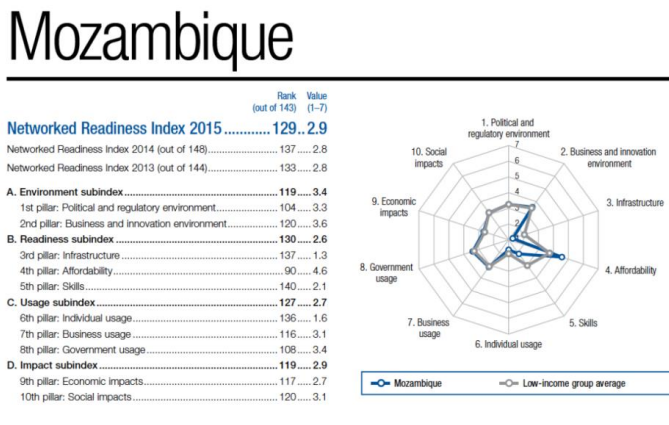
¹ In a personal communication with Minister of Science and Technology in 2005, Minister Honourable Prof. Doctor Eng. Venâncio Massingue, he used as example that the need to develop knowledge and skills to prevent the many deaths per year by the annual flooding of the Zambezi basin was much more important for Mozambique than developing MoRENet.

of course challenging, with political, bureaucratic and personal hurdles that had to be taken. Because the two ministries could not form one front, MoRENet did not emerge to the level of national policy attention. Government support at the highest level is essential for the sustainability of any NREN and Mozambique is no exception. This support needn't always be in terms of financial resources, in the case of MoRENet government could have negotiated with TDM to offer affordable tariffs for the national connectivity or other compensatory mechanisms. Finally, MoRENet was presented as a technical project with the Higher Education and Research sector as sole beneficiary. The initiative was not linked to the necessity to transform the higher education sector as part of the information or knowledge society approach frameworks, although it was a priority project of the ICT Policy Implementation Strategy intended to contribute in building the information society in Mozambique(Council of Ministers, 2000, 2002, UNDESA, 2005)

In short: MoRENet was not embedded in in the Higher Education and Research institutions and lacked a financial plan. By no means is this resumé meant as criticism of the efforts of the Government of Mozambique, in particular the Ministry of Science and Technology. The Government of Mozambique had the vision that Mozambique needed an NREN, as indicated in its ICT Policy (Council of Ministers 2000), and that the NREN should be part of a regional network of NRENs, there was a MoRENet business model (even though the financial chapter was missing) and the leadership of the Ministry of Science and Technology was enthusiastic advocates of the MoRENet. Without the involvement and leadership of the Ministry of Science and Technology there would be no MoRENet today!

3. Network Readiness

That ICT is the driving force in the transformation to the Knowledge society is not disputed, as well as the fact that the path to the Knowledge Society is the only way to economic development and a sustainable society. But the role of NRENs in this process should be emphasized more. Since 2005 the Network Readiness Index (NRI) of more than 120 countries has been monitored. The NRI gives an indication of how fit a country is to deal with the transition to this Knowledge Society. The NRI is based on the assessment of 10 ICT related pillars. For example the 2015 NRI of Mozambique is 2.9 out of 7.0 maximum points



(rank 129 out of 143 ten pillars are in the context of this

Figure 1 Mozambican NRI 2015

countries). The base values of the presented in Figure 2. paper it is relevant to mention that a

strong NREN can contribute to the advancement of the pillars 3 (Infrastructure), 4 (Affordability), 5 (Skills), 6 (Individual Usage) and indirectly, by delivering ICT savvy young people to society, 7 (Business Usage). This would be some of the variable or dimensions (social outputs and impact) [6] that should have been used to argue for social and economic value of MoRENet (Chemane, L., 2010, Keeney, R., 1992, UNDESA, 2005) to build a strong argument to secure the financing of MoRENet and even to construct a scenario for the preferential treatment of this education initiative by the telecom sector. Further discussion of the NRI could be very interesting, but does not fit in the time allocated for this paper. What is important is that the NRI can be a powerful tool to prove the value of NRENs for society and should be used more often (Pale, P. 2001, Popov, O.2001,UNDESA, 2005)

For example one might want to demonstrate the relation between the quality of education and the availability of Internet in schools with the trend graph in Figure 3 (based on the real data!).

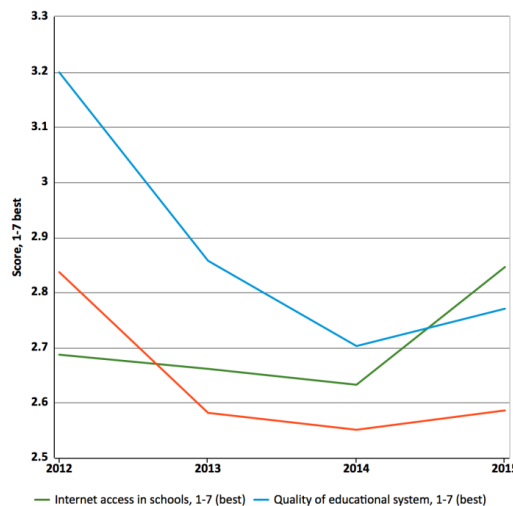


Figure 3 Relation between Internet access in schools and Quality of Education ?

4. Revival of MoRENet (2011-2013)

In 2006 the Higher Education section of the Ministry of Education and Culture had started a Dutch funded project with the aim of strengthening the management capacities of Mozambican public universities. One of the work packages of the project was to develop and implement a Student Information System (SIS) for the participating Higher Education Institutions. This SIS would not only enable the institutions to efficiently and effectively manage the student information, it would also be a platform to provide the ministry with metadata about the student cohorts. Without a national network this meant that the required data was burned on CD's and then sent per snail mail to the ministry. Also software updates of the local systems were burned on CD's and sent to the IT departments of the institutions. This was of course not the ideal work flow, anno 2006/2007, and the conclusion was that Mozambique needed in fact a national network for Higher Education (there were of course many other reasons why this network was necessary, but the SIS was a visible demonstration of why this network is a necessity) at least from the Ministry of Education point of view

(Weick, K., & Sutcliffe, K, 2005). The project was already several years underway before the Dutch project manager became aware that somewhere within the Ministry of Science and Technology somebody was working on a project to create a national network, namely MoRENet. This initiative was not enjoying the necessary support within the Ministry of Education and Culture.

Once the link between the Higher Education project and the MoRENet initiative had been established a bottom up approach was followed (Weick, K., & Sutcliffe, K, 2005) A short overview of the steps that were taken follows:

- The Ministry of Science and Technology has already secured World Bank funding for the MoRENet project, through the Mozambique eGovernment and Communications Infrastructure Project (MEGCIP)(World Bank 2009)on the condition that it should be used on the base of a MoRENet Business Model, including a financial plan, that proved that MoRENet would become a sustainable organisation.
- The IT departments of the public universities and the Ministry of Education and Culture were informed of the project and involved in the progress.
- The Minister of Education and Culture called for a meeting of the rectors of the public universities (with mandatory attendance).
- There was a formal meeting of the Minister of Science and Technology and the vice-Minister of Education and Culture to underline the commitment to jointly go forward with the MoRENet project.

During this period a few external events took place that were of advantage to the MoRENet initiative:

- In 2009 SEACOM, a submarine cable operator had begun to provide Internet connectivity to Mozambique through their landing point in Maputo. This increased the available Internet bandwidth in Mozambique twenty fold and as a result the tariffs dropped significantly. UEM was the first public university to profit from this when they negotiated a 15 years lease of a STM-1 (155 Mbps) circuit to Europe.
- In 2012 Movitel, the third Mobile operator in Mozambique entered the Mozambican market for mobile, fixed line and Inter services. Not only did this terminate the monopoly position of TDM on leased line services, also Movitel's business model was very attractive for MoRENet. To avoid the fierce competition in the capital, Movitel first concentrated on rolling out telecom infrastructure to the rural areas of Mozambique and also offered to provide free Internet for schools while doing so.

5. The MoRENet Business Model

In 2012, with the help of a consultant contracted as part of the implementation of the Mozambique eGovernment and Communications Infrastructure Project (MEGCIP)[9], a MoRENet business model (Janz, R., 2013)was developed, together with a financial plan. The model has been developed in various iterations where involvement of the future member constituency was sought for guidance and ratification. In the business model all the aspects of a business model are presented ranging from the mission, the challenges that are faced, the services that will be provided, the potential customers, the organisational setup and the governance. These elements come together in the final chapter with the financial model. The summary of the subsequent chapters is as follows:

In **The Case of the NREN** the ambitions of MoRENet are laid down. At a global level NRENs have been identified as important vehicles in developing Knowledge Societies,

demonstrating the need of creating a similar institute in Mozambique. In the international ranking of Networked Readiness Index Mozambique is ranked as 120 (of 138) and it is demonstrated that a NREN can contribute to the improvement of this Network Readiness Index. MoRENet is to be an independent, not-for-profit organisation that will first provide affordable Internet for its user constituency and later also provide other services.

In **Mozambican Telecom Analysis** the situation with regard to the telecom situation in Mozambique is analysed. Four connectivity levels have been distinguished: the Local Network, the Last Mile, the Last Mile and International **Bandwidth**.

Comment [n1]: Why two last miles?

Many of the potential members are far away from the national fibre optic grid and need financial support to connect to the nearest MoRENet Point of Presence (PoP). The Last Mile challenges of all the potential members of MoRENet needs to be inventoried. The national telecom regulator, INCM, should be involved to assist in solving the Last Mile challenge.

TDM has a dominant role in providing capacity at the national level in Mozambique. The tariff structure of TDM stands in the way of setting up a sustainable MoRENet to provide its services not only in the capital Maputo, but also to the institutions that are in the provinces. The current customer-provider relation between MoRENet and TDM needs to be changed to a partnership if MoRENet is to succeed with TDM as provider. There also other providers that can act as partner for MoREnet, such as Movitel and EDM. If TDM is not willing to go into a partnership with MoREnet then discussions with these providers should be initiated.

The current contract for an STM-1 to London with SEACOM can be re-allocated for another purposes once the Africa Connect bandwidth becomes available as long term sustainability of MoRENet is best guaranteed if it makes use of the services that are to be offered by the UbuntuNet Alliance. Another option is to keep the SEACOM link as part of MoRENet as redundant international link.

In **User Analysis** an overview of the potential members of MoRENet is provided. It is observed that the HEI sector is not yet involved at the strategic level of the MoRENet development. As the HEI sector will prove to be the motor to reach a sustainable situation this situation has to be changed. Further not all potential MoRENet members will be able to make use of its services from the beginning. A certain ICT maturity level will have to be reached before they can connect. The list of potential MoRENet members needs to be updated and an inventory of the maturity status of these institutions needs to be made. In this chapter the concept of federations is introduced as a way for MoREnet to provide services to a variety of client groups. Finally the budget capacity of the potential MoRENet members is introduced: the members are currently paying around \$ 1,300,000.- per year for 100 Mbps external bandwidth.

In **MoRENet Services** the services that MoRENet will provide are presented in a layered approach. Within these layers first the “Must have” services will be implemented, followed by the “Should have” services. “Nice to have” services are placed on the back burner and will mostly be implemented by external parties.

In **MoRENet Network Architecture** the layout of the MoRENet infrastructure is presented, including the roadmap to reach this situation. It is the ambition to provide a network with a backbone capacity of 155 Mbps, with minimum access bandwidth of 34 Mbps for those institutions that are able to connect to the MoRENet PoP via fibre optic. An ambitious time line is presented to role out the network, starting in the second half of 2012 and ending and year later in the last quarter of 2013.

In the **MoRENet Governance Model** MoRENet is to be setup as a separate entity within the state company ENPCT with its own financial responsibility. MoRENet is governed by a Council of Representatives (high level) and a MoRENet Board (day to day management). MoRENet will have a multi-year financial planning horizon and a yearly activity plan to secure a stable financial basis. The service portfolio will be based on Service Level Agreements in contracts with the individual members of MoRENet.

The **MoRENet Organisation** should consist of a management, with support unit, and three operational units: Network Management, Service Management and User Support. An organisation of 18 fte is foreseen, to be implemented over the period 2012 – 2013.

In **MoRENet Tariff Model** two tariff models are presented: a bandwidth dependent model and a mixed bandwidth/member dependent model. A policy decision with regard to the model that will be implemented can only be made once the financial model of MoRENet has been finalised.

In the **Financial Plan** the outline of the organisation as it has evolved in the preceding chapters comes together in the financial plan over the period 2012 – 2016. The first analyses provided financial models that were not sustainable, with the costs of the national backbone being the case breaker. In the Final version of December 2012 no sustainable scenario had been identified. In the spring of 2013 new financial data and some adjustments to the parameters of the plan were fed into the financial plan. As a result a sustainable financial plan can be presented. It is strongly advised to make use of the Movitel offer to provide the circuits for the national network.

6. Further implementation of MoRENet (2014 – 2015)

As part of the MEGCIP Project (World Bank, 2009) support to MoRENet a number of bids have been prepared and launched to support the expansion and improvement of MoRENet international and national data communication capacity as well as IT infrastructure for data processing and storage. From 2014 two STM1s (155 Mbps each) contracts have been awarded, one to SEACOM and another to UbuntuNet Alliance for improving the MoRENet international access to international and regional research and education network as well as to the Internet.

The number of MoRENet beneficiary institutions has increased and today 20 research and education institutions, including institutions at provincial level are benefiting from MoRENet. The number of research and higher education institutions benefiting from MoRENet will increase to about 89 institutions at the end of 2015 as part of the deployment of national connectivity services provided by Movitel, the telecom operator contracted as part of the MEGCIP Project support to MoRENet in the deployment of the MoRENet national backbone network as well as the access links to the MoRENet beneficiary institutions. Movitel won a bid launched as part of the MEGCIP Project to contract provide national data connectivity services for MoRENet, covering MoRENet national backbone network and beneficiary institutions access links.

One of the weaknesses of the MoRENet initial approach of providing connectivity to the IT computer centres of the universities, limiting the number of students benefiting from MoRENet, has also been addressed within the MEGCIP Project support to MoRENet. An

initiative to establish university wireless campus network has been approved. A bid was launched and 16 wireless campus networks are now being established in 16 higher education institutions interconnect by MoRENNet. This initiative is contributing to increase the number of beneficiaries of the international bandwidth contracted to MoRENNet. Any one at the university campus network benefiting from this initiative, with the appropriated access credentials can benefit from MoRENNet services using his/her own device, including cellphone, IP Pad, Laptop, etc.

A dedicated MoRENNet technical team, covering the posts defined in the MoRENNet Business Plan (Janz, R.,2013), has been established from 2014, and a MoRENNet board has been appointed in 2015 by the Minister of Science and Technology, Higher and Technic Professional Education. These developments are addressing the organizational and structural challenges of MoRENNet and they have been proposed in the MoRENNet Business Plan.

As part of the Ministry of Science and Technology to MoRENNet, through the MEGCIP Project, a number of bids to purchase equipment for the MoRENNet NOC (Network Operations Centers) have also been launched and the equipment provided and operational at the Maluana Science and Technology Park.

A number of initiatives to forge partnerships (Weick, K., & Sutcliffe, K, 2005) with other NRENs, has been undertaken by the Ministry of Science and Technology, examples of such initiatives include formal MoU with the RNP (Rede Nacional de Pesquisa), the Brazilian NREN, informal support from TENET and KENET. An example is also the support from UbuntuNet. The MoRENNet technical team has benefited from a number of capacity building initiatives such as training and participation in international NREN related events as part of these relationships (cooperation and collaboration).

These are examples of initiatives of support from Government implemented in 2014 and 2015 that are changing the shape of MoRENNet and need to further be strengthened.

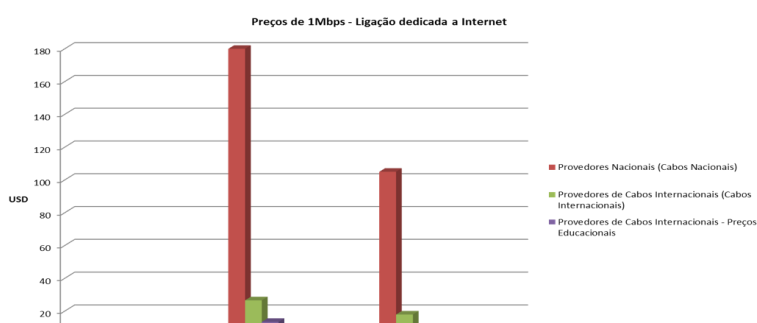


Figure 4 The cost reduction for Internet Access in 2013 compared to 2011

Figure 4 shows the impact of an approach like MoRENNet in reducing the cost of Internet access for research and education community if capacity is purchased in a shared approach [4]. The data above is from the bids launched by MEGCIP in 2011 and 2013 as part of the process of purchasing international and national data communication capacity for MoRENNet. While in 2011 the price of 1 Mbps Internet access in a ISP or telecommunications service providers was about 180 USD in average, the same capacity was about 25 USD if purchased in international submarine cable operators and about 12 USD using educational prices

offered by international submarine cable operators. These prices reduced to 100 USD, 17 USD and 10 USD respectively.

7. Conclusion

Regardless of the difficulties and challenges faced by MoRENet in the first years of its implementation, this paper show that with the appropriate measures and political decisions it was possible to overcome those difficulties and move a strategic project like MoRENet forward.

The prospect of MoRENet are today positive, having experienced fast development in the previous two to three years, that resulted from appropriate allocation of financial resources and building of an environment that allowed the participation of the main interested parties in an initiative like MoRENet.

It is critical at this stage to develop efforts to sustain the momentum gained by MoRENet with the Ministry of Science and Technology, Higher and Technical Education, through the MEGCIP Project, and mobilize additional support from the government, the provide sector as well as from the academia to build on the MoRENet success so far achieved. The increase of the MoRENet international data communication capacity as well as of the national data communications capacity will be critical in the near future, as a result and natural consequence of the increase on the number of beneficiary institutions and the number of users at the campus level.

Looking ahead it will be of great importance for MoRENet to derive strategies to transform this network into a value network for the research and academic community in Mozambique by developing and providing data communication services and not only connectivity and Internet access services. It is to encourage the implementation of MoRENet services included in the MoRENet Business plan, mainly those that are part of the collaboration between MoRENet and RNP, namely: VoIP services for the members of the MoRENet community, the Eduroam services, the federation of identity initiatives, web conference services, hosting services, mail services etc.

The success on MoRENet is also strongly tied to the establishment of the governance structure proposed in the MoRENet Business Plan, and mainly the adoption of governance principles and approaches for this initiative that will allow equal footing of all the interested parties and MoRENet stakeholders in the MoRENet management as well as in MoRENet oversight and decision making processes.

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Biography

Robert Janz



After graduating as Theoretical Biologist at the University of Groningen in The Netherlands Robert Janz has, professionally, mainly been active in the area of ICT and Academia. Since 1981 he is employed by the Computing Centre (now named the Centre for Information Technology) of the University of Groningen. Starting as lecturer he became the Technical Director of the Computing Centre in 1995. In 2005 he switched to the position of senior project manager. In this position the focus was on initiating and implementing large multi-partner ICT projects with the University of Groningen as one of the leading partners, such as the ICT part of the LOFAR project, the Groningen Internet Exchange, the Big data project TARGET and the municipal wireless network of the city of Groningen. In the international context Robert has been active in implementing large ICT projects in the Higher Education and Research sector in Africa and Central Asia. In the recent years the focus has been on developing sustainable NRENs in sub-Saharan Africa (Zambia, Mali and Mozambique) and Central Asia, including Afghanistan.

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