

# The GÉANT Green Team: an Example of How Organizations Can Use a Community Approach to Promote the Use of ICT in Sustainability Efforts

A. Hankel

SURFnet

Utrecht, Netherlands

e-mail: albert.hankel@surfnet.nl

H. Astsatryan, W. Narsisian

Institute for Informatics and  
Automation Problems of NAS RA

Yerevan, Armenia

e-mail: {hrach,wahi}@sci.am

## ABSTRACT

This paper summarizes the work done in the GÉANT Green Team, a European collaboration between National Research and Education Networks to stimulate (environmental) sustainability in these organizations. We show some of the tools that have been developed in this team, which are applied to train NRENs new to the topic, such as the Armenian NREN. Through this work we hope to show the merit of how likewise organizations can collaborate and inspire other organizations to do the same.

## Keywords

GREEN ICT, Inter-organizational collaboration, GEANT, ECO2METER, Environmental Policy, ASNET-AM, GHG

## 1. INTRODUCTION

Countries, organizations and individuals are becoming increasingly aware of the need to transition to a sustainable low-carbon society. In order to do so, we need to use renewable energy; become much more energy efficient; reduce the amount of (exotic) materials we need; minimize waste production; stimulate sharing (in communities) and help each other to change our awareness and behavior. As we are witnessing how information and communication technologies are changing society, many innovations and efficiency gains needed for this transition are made possible by (Green) ICT.

Green ICT is often defined using the words of Murugesan [1]: “It’s the study and practice of designing, manufacturing, using and disposing of computers, servers, and associated subsystems ... efficiently and effectively with minimal or no impact on the environment”. While this adequately defines the environmental problem set within the ICT-sector, it leaves out the enabling effects that ICT-solutions can bring to other sectors. As a general-purpose technology information and communication technologies can be used by themselves or as part of other technologies. This is the reason why ICT is viewed as an environmental friendly solution: even though the global environmental impact of ICT itself is significant (roughly 2%), making something else more efficient has a much larger effect (potential reduction of 16% of the global footprint) [2].

ICT can impact sustainability efforts in multiple ways. Through automation and digitalization, ICT can optimize processes and substitute physical activities for digital activities (and as a result dematerialize the footprint). In addition, ICT can provide valuable information through data mining and analyses to support decision-making and give

timely feedback on our behavior. The impact of these properties in ICT can already be seen in society: with traditional examples such as paperless workflows or videoconferencing and more modern innovations such as sharing vehicles or smart metering and smart grids.

As innovative organizations close to the needs of society, smart use of ICT for sustainability is naturally relevant for National Research and Education Networks (NRENs). This has also been recognized by the European Union in their funding for the GÉANT GN3 (+) and GN4 programs [3], which support innovation in the European research and education networks. GÉANT is the pan-European research and education network that interconnects Europe’s NRENs.

Activities related to Green ICT have been included in these programs, which are carried out by the so-called GÉANT Environmental “Green” Team. In the team a number of European NRENs are working together. The focus of this team is not only on greening their own organizations, but also explicitly to help the higher education and research community becoming more sustainable.

With activities ranging from performing green house gas (GHG) audits, setting up services that reduce carbon footprint such as videoconferencing, designing an environmental policy template and publishing best practices, the GÉANT Green Team tries to push the boundaries on what can be done with ICT. In this paper we will demonstrate the work that is being done in the team, and how this is made relevant for the higher education community. In addition we want to show how likewise organizations can collaborate and learn from each other by describing the community approach that NRENs take.

## 2. GREEN TEAM ACTIVITIES

Over the past years the GÉANT Green Team has developed a number of activities and tools to help support the sustainability efforts carried out by the individual NRENs as well as promote best practices amongst each other. Here we want to highlight three efforts in particular: the ECO2METER [4], a template for developing an environmental policy and a maturity model for Green ICT.

### 2.1. ECO2METER

The ECO2METER is an online tool, which NRENs can use to calculate their yearly energy consumption and GHG emissions. The design of the online tool is based on the - international widely used - ISO 14064 standard for reporting GHG emissions. For NRENs, GHG emissions can be consolidated into four categories, which are: the office, the

data centers, the network itself and personnel travels (incl. commuting). Each category is measured using a predefined structure, which the tool uses to prompt the user for data input. After an NREN has supplied all the required input, the tool can automatically generate an ISO14064 compliant report. The results can be used to deduce useful conclusions regarding the more energy-hungry parts of the NRENs infrastructure, help measure the environmental impact of (energy efficient) changes made and compare the different NREN infrastructures to learn from each other. Working on a GHG audit has proven to be a good first step for NRENs new to sustainability and green ICT. They can identify the low hanging fruits for improvements and learn from other NRENs through previously documented best practices.

## 2.2. Environmental Policy Template

Becoming more sustainable is an effort that impacts everything in an organization. Top-down support is therefore essential. In order to facilitate this process, the Green Team has developed an environmental policy template for NRENs. This is a template specially designed for NRENs with which they can easily create an environmental sustainability policy. The template provides a sample motivation, a number of action statements and examples for activities that connect to these statements. The template is designed in such a way that NRENs can pick and choose the policy statements that are appropriate. The statements provided can apply to efforts in the own organization, providing green services to their higher education and research (HE&R) clients, and stimulating sustainability efforts in the HE&R community. With these dimensions, the policy can fit different NREN ambitions. Since the publication of the template, more than 10 NRENs have published their environmental policy on their website.

For NRENs, such policies can be a key tool to demonstrate their environmental priorities to both the higher education community as well as the general (international) society. The GÉANT Green Team believes having an environmental policy is an important step towards a truly sustainable organization.

## 2.3. Maturity Model for Green ICT

In order to provide organizations practical insight into everything Green ICT has to offer, a maturity model was created. The concept of the maturity model is based on the Capability Maturity Model [5], representing a framework with five maturity levels for quality and process improvements. The five levels are (1) initial, (2) repeatable, (3) defined, (4) managed and (5) optimizing. At the lowest level, the initial level, the organization does not provide a stable environment for the activity. At this level the process is ad hoc. However, at the highest level, which is the optimizing level, the entire organization is focused on continuous process improvement [6].

Because this model is designed with higher education institutions in mind, it is designed from the perspective of an ICT department in a larger organization. It is however not limited to the higher education and research community and can be used by any organization. It is set-up as a self-assessment and enables organizations to have an internal dialogue, to gain agreement on the status quo and to define actions for improvement. Table 1 shows all the topics (or attributes) in the model.

By letting several individuals within an organization score the attributes and discussing these scores with the participants (average, minimum, maximum scores, etc.), an organization can identify weak and strong Green ICT aspects. These can then be improved upon – the model provides some suggestions to do so, but organizations can also learn from each other, copying best practices for example. If the model is used repeatedly and its results acted upon, an organization can grow towards leadership in sustainability and Green ICT.

Green ICT in the organization	Greening of ICT	Greening of operations with ICT
Green ICT Strategy	Housing	Travel Reductions with ICT
Governance of ICT services	Computing Infrastructure	Area Reductions with ICT
Green ICT Procurement	Network Infrastructure	Energy Reductions with ICT
E-waste policy	Storage Infrastructure	Paper Reductions with ICT
Green ICT in Information Management and Architecture	End User ICT Equipment	Feedback and Decision Support
Community Collaboration	Software and ICT Services	
Green ICT Supply Chain Management		

Table 1 Attributes in the Green ICT Maturity Model.

## 3. INTRODUCTION OF ARMENIAN NREN

Armenian e-infrastructure [7] is a complex national IT infrastructure, which consists of both communication and distributed computing infrastructures. The infrastructure is operated by the Institute for Informatics and Automation Problems (IIAP, <http://iiap.sci.am>), which is the leading ICT research and technology development institute of the National Academy of Sciences of the Republic of Armenia. Academic Scientific Research Computer Network of Armenia (ASNET-AM) [8] is a National Research and Education Network (NREN) of Armenia, which was established in 1994. ASNET-AM stimulates scientific development through innovative high-quality network infrastructures and associated services, to the benefit of Armenian higher education and research. ASNET-AM provides a network infrastructure for the Armenian research and education community by connecting more than 60 scientific, research, educational, cultural and other organizations of Armenia. Most of the sites located in Yerevan are connected over ASNET-AM's fiber at bitrates of 1 Gb/s. Other sites, including those located outside Yerevan, are connected with wireless links via the television station. A few key sites such as the Presidium of NAS RA and the IIAP are interconnected at 10 Gb/s.

The ASNET-AM backbone consists of network communication nodes in 6 cities of Armenia, which are interconnected by fiber optics and wireless links (see fig. 1).

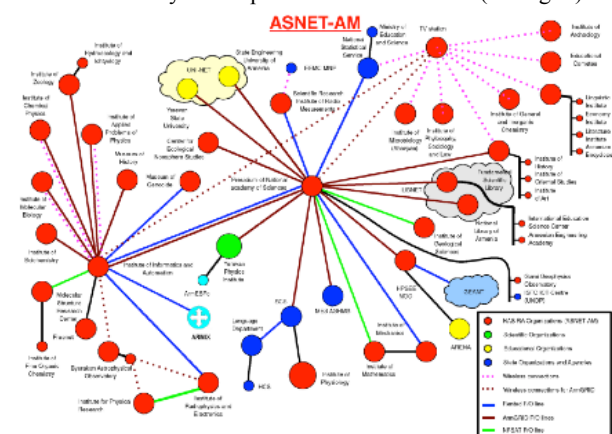


Fig. 1 Topology of ASNET-AM

Being a long-time Armenian academic network operator ASNET-AM participates in a series of international activities. ASNET-AM activities in the sphere of international cooperation provides an opportunity to present Armenia and its academic research community. In the next five years the national backbone of ASNET-AM will be connected to GEANT through the EU Eastern Partnership Connect (EaPConnect) project [9]. This project aims at creating a regional high-speed Internet network dedicated to research and education in the Eastern Partnership countries.

### 3. SUSTAINABILITY TRAINING AND APPLICATION IN ARMENIA

With the combination of the three-abovementioned tools, the GÉANT Green Team can now provide training to the whole NREN community. The team has developed a training schedule and has made this available for any NREN interested. During such a training the tools will be demonstrated and used by the participants. Best practices documented by the team provide examples of how improvements can be made. The Armenian NREN ASNET-AM is currently undergoing this training and will be used as an example here. The first results of this training will be included in the final paper.

### 4. CONCLUSION & DISCUSSION

We believe the GÉANT Green Team sets an example on how likewise organizations can collaborate and learn from each other. By developing tools that can be useful for all participating organizations the team creates an open collaborative environment that stimulates sharing experiences and learning from each other.

Furthermore the tools and best practices developed are not necessarily restricted to the NREN-community. Already we have seen that other organizations want to use the maturity model for example. For us this shows that our community approach is effective, even outside our own community.

Sustainability is typically a topic that requires efforts from all parts of an organization but also collaboration between organizations. It is not something that individuals can solve on their own and therefore a collaborative, community approach can be highly effective. The GÉANT Green Team

is an example of such an approach and we hope that by demonstrating our practices other sectors will follow our example.

### 5. ACKNOWLEDGEMENT

This work was supported by the European Commission through the GN4 Project.

### REFERENCES

- [1] San Murugesan, "Harnessing Green IT: Principles and Practices," IEEE IT Professional, pp. 24-33, January–February 2008.
- [2] GeSI (2012). SMARTer2020: The Role of ICT in Driving a Sustainable Future. <http://gesi.org/SMARTer2020>
- [3] GÉANT Project, [online] Available: <http://www.geant.net/>
- [4] ECO2METER, <http://eco2meter.grnet.gr>
- [5] M.C. Paulk, B. Curtis, M.B. Chrissis, and C.V. Weber, "Capability maturity model, version 1.1", Software, IEEE, 10 (4), 18–27, 1993.
- [6] A. Hankel, L. Oud, M. Saan, & P. Lago. "A Maturity Model for Green ICT: The case of the SURF Green ICT Maturity Model". EnviroInfo 2014.
- [7] Yu. Shoukourian, V. Sahakyan, H. Atsatryan, "E-Infrastructures in Armenia: Virtual Research Environments", IEEE Proceedings of the Conference Computer Science and Information Technologies (CSIT), 2013, pp. 1-7, DOI: 10.1109/CSITechnol.2013.6710360
- [8] Academic Scientific Research Computer Network of Armenia, <http://www.asnet.am>
- [9] Eastern Partnership Connect project, <http://www.eapconnect.eu/>