



Session Title:
Making Community-Driven Networks a Reality

Community Driven Networks, Rwanda case study

Albert Nsengiyumva
Rwanda Education and Research Network (RWEDNET)

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Abstract

About one third of the African population still **has** no access to voice communication and the Internet. In remote areas, both the high cost of Infrastructure and **of** operating ICTs with generators and satellite backhaul make spreading access a tough business case, especially when financially healthier growth is still available. Universal access funds are, in the main, slow moving as funds sit idle too long and moreover they provide too few incentives to create new low-cost business models. Yet, the coverage and population density maps are studded with areas that might sustain growth on a different cost base. The community owned networks that are emerging in other places of the world, such as Latin America **and** Asia are good models to learn from, provided that alternative policies and regulatory measures are **followed** to allow an enabling environment for Community Driven Networks to emerge.

This paper discusses the potential uses of Community Driven Networks (CDN) in Sub-Saharan Africa with reference to the preliminary results from a CDN pilot project in Rwanda. **Using** past experience from other continents, pilot sites which had the best chance of success **were chosen**. We discuss a case study in the town of Nyamata, 40kms from Kigali city, including the economic background, needs assessment and some initial findings. We then argue the utility and viability of the CDN model as compared to other rural access initiatives in operation.

1.0 Introduction

The current trend of globalization **stimulates** innovative approaches that can allow the African continent as a whole, and Sub Saharan Africa in particular, to enhance its service delivery through the use and adoption of ICTs at all levels of the economy. In the current context of knowledge creation, management and sharing across the globe, the issue is no longer the capacity needed to access information and knowledge for the benefit of our citizens, but rather **the investigation of** better ways **to** reach out **to** those in need **in particular**, the major part of **the** local population living in rural areas where basic infrastructure is lacking. The Universal Access Fund model that has **existed** for many years, has failed to provide alternative models to sustain ICTs in **the** remote areas of **many countries**.

The proposed Community Driven Networks model relies on key assumptions that are critical for the model to succeed:

- A level of community ownership (business and governance model...)
- Affordable technologies (wireless, alternative energy, PCs with low power consumption, VOIP...)
- Stimulation of demand for local versus national market (asymmetric termination tariff, subsidized local traffic, **creation of** local content...)

The following paper provides an overview of an ongoing effort to promote Community Driven Networks (CDNs) around the East African Region. This will be extended to other African regions once it **achieves** substantial results and lessons learnt that could be replicated in other regions/countries. My particular focus is on the Rwanda case study. The first phase of initiating the CDNs has been completed and we are moving into a pre-implementation phase of a pilot in Nyamata Town in the District of Bugesera. The first phase of CDN activities included a research activity in Nyamata Town and awareness and advocacy campaigns around key institutions and individuals who could help to promote CDNs in Rwanda. The second phase, currently underway, **focuses** on market and technical assessment to build a pilot CDN in Nyamata Town, and on advocacy and partnership building with local community, national and international partners.

By transforming the economy from being predominantly agricultural to an information-rich and knowledge-based **economy**, Rwanda has envisioned its economy moving to the middle income bracket by the year 2020,. The GoR has decided to use ICT as one of the tools to reach this developmental goal (see Table 1 for ICT Policy highlights). The country has **experienced** major economic reforms including **reforms** in telecommunications, with the aim **to increase** competitiveness **in** telecommunications industry and **to** attract foreign investment. These measures **so far** have met with modest success, with both access to telephony and international bandwidth **steadily** increasing over the past few years (see Tables 1 and 2). However, the challenge of spreading this increased access beyond major urban centres remains and Rwanda is committed to addressing this challenge.

Table 1 – ICT policy highlights as of 2007

Telecoms services	Policy
Fixed lines	Rwandatel is the major telecom operator in Rwanda providing voice telephony and Internet services. MTN Rwandacell is also licensed to offer fixed line services though it is not yet operational.
Mobile Services	MTN-Rwanda cell is the main private mobile telephony company established in 1998. In October 2005, a mobile license was awarded to Rwandatel and it is providing mobile services using CDMA technology
Internet service Providers	Rwandatel is the major Internet Provider. The three others are: MTN Rwandacell , Artel Communications (issued a Voice and Internet Operator license for under-served areas) and ISPA , a small ISP launched in 2005 focusing on corporate wireless connectivity. Two academic institutions have free licenses to provide internet services over VSAT for academic and research purposes.
Cyber cafes & Community Centres	500 cyber cafes are estimated to be operational in the Country with 75% located in the Capital Kigali. There is no license required to operate a cyber cafe. Community Centres are being deployed in remote areas and are supported by both government and international organizations
Call Centre services	MTN-Rwandacell and Electrogaz , the power company have call centres for their own customers. In addition, Business Communication Service (BCS) has a call centre business which is used to service Tuvugane and its taxi enterprise as internal clients. Locally, it is looking for other companies to develop a customer portfolio for the call centre
VSAT	20 Broadband VSATs are operational in Rwanda owned mainly by international organizations, ISPs and higher educational institutions. License fee is USD 5525 per year plus 15% of the monthly satellite segment fee Around 400 narrowband VSATs are deployed by Artel in the country side
VoIP	VoIP is not legal. The current duopoly licenses allow MTN and Terracom to use and offer VoIP services as their licenses are all-encompassing. However the legalization of VoIP by the regulator is at the preliminary stage.

2.0 Discussion

2.1 Development & ICT challenges

Problems facing rural ICTs are well known, not just in Africa but in much of Asia and Latin America.

- Poor people either lack telephony services altogether, or face tariffs that limit their use to emergencies;
- Such high tariffs can result in a significant proportion of overall rural income being extracted from the area even **though** one of the critical needs is to retain and draw in resources;
- In the absence of fixed lines and low-cost international connections, bandwidth charges remain extremely high for ICT services, **that** usually **are** relayed **by** satellite. **This** **limits** the spread of cybercafés and **requires** large subsidies for telecentres **which** few can sustain;

- ICT services, where they are available, are not always suited to local needs and relevant local content remains a key constraint.
- Even where services could be delivered effectively through ICT, communities remain underserved due to a lack of awareness of the role of ICT and limitations in the pursued business model.
- Securing access to services is not simply a question of delivering them but also of empowering the community to access, to effectively use and to secure broader development benefits from them.

Table 2. Increase in the number of mobile and fixed subscribers

Company	Service	2001	2002	2003	2004	2005	2006
Rwandatel	Fixed Lines	21,458	25,105	25,565	22,972	23,903	21,600
	Public Telephones				3,933	N/A	N/A
MTN Rwandacell	Mobile Lines	44,117	82,391	97,261	137,271	219,657	303,612
	Public mobile phones				1,457	3500	5000
ARTEL		0	60	304	452	490	N/A
TOTAL		65,575	107,556	123,130	166,085	244,050	

Source: RURA Annual Report 2004 and Desk research

Tele density is estimated at 2.09 per 100 people;

For the fixed network: 0.3 per 100;

For the mobile network: 2.9 per100.

2.2 Emerging promising options

More recently attention has been shifting to the examination of the potential of new network management and ownership models and to the role of local communities in enhancing local service delivery and access. In part, this results from both the investigation of options to enhance competition which would reduce tariffs and the mixed success of universal access funds and licensing schemes where awarded contracts often remained unfilled. These new models should have the potential both to enable development activities and dynamics using ICTs, and to capture the value-added and profits of ICTs as a sector for the local community. The value does not come just from the use of ICTs to enable development, it also stems from the capacity building and income generated by the cooperative enterprise. Both as an enabler of a range of development activities and as a sector in itself, the project's goal is to empower poor communities through the benefits of ICTs.

2.3 Nyamata Town, case study

Bugesera District is part of the Eastern Province close to the Burundian border. Located 40 kilometres from Kigali, the capital of Rwanda, it can be classified as a rural area with the potential to grow and become a big suburb of Kigali, especially as a connecting

highway is under construction and a modern and, within five years, a regional airport is planned for the Bugesera area. Nyamata is the main town of Bugesera and hosts the main socio-economic activities of the whole district.

The distribution of the population is as follows:

- Estimated Population : 58,313
- Female : 56%
- Male : 44%
- Percentage of youth under 16: 55%
- Percentage of people with less than US\$ 2 a day: 62%

Bugesera District produces a variety of agricultural products and a great number of farmers work in cooperatives. A large number of micro finance institutions support poverty alleviation by assisting community driven local business initiatives. The education sector, especially at the primary and secondary level, is well represented, even above the national average. As there is no higher learning institution, students in the area must move to Kigali and Butare for higher education. In some cases students travel to Kigali on a daily basis to attend classes. There is one main public hospital in the main town of Nyamata and several health centres around the district. As far as governance is concerned, the district has motivated local leaders, both newly elected and appointed. This is part of the decentralization process and administration reforms that took place in Rwanda early in 2006. These policy initiatives aim to facilitate citizen participation in the decision making process as well as to provide government services at the local level.

As in most rural areas around the country, the general infrastructure is still lacking. Access to electricity, telecommunication and clean water is very poor despite the proximity to the capital.

2.4 Needs assessment in Nyamata Town

The needs assessment approach involved a combination of a 'community score card', and a 'futures' methodology. Community Score Cards (CSC) are a qualitative participatory tool used to provide feedback of user perceptions on the quality, adequacy and efficiency of services at the local level. On the other hand, the futures methodology is employed in the process of creating dialogue among key stakeholders on various future-oriented topics of discussion and debate (Candy 2004).

A combination of the two approaches was geared towards obtaining information on the current role of ICTs in community activities, as well as, creating a framework within which the information obtained could provide a basis upon which to initiate processes for advocacy and future policy influence for pro-poor ICTs, as manifested by the representatives of the poor themselves.

2.5 Choice of the project site

The predetermined criteria for site selection were as follows:

- Pre-existing ICT experience, such as a telecentre, schools/health network etc. (i.e. on the margins but with some ICT provision);
- Some capacity in (non-ICT) networking activities, for instance around NGOs, cooperatives, women's groups etc.;
- An area sufficiently large to engage in meaningful local networking, such as half a dozen junior schools, a number of health centres, local government service centre/s, some agriculture or production cooperatives/enterprises;
- The presence of **locally delivered** public services.

Drawing from the above information on Bugesera, representatives of existing **community** groups were purposely selected as key informants to represent all categories of community members. The **four** categories are:

- Health sector representatives;
- Education sector representatives;
- Private sector representatives;
- 'Community' representatives (local associations, farmers, women's groups).

2.6 The community driven networking model

The ongoing decentralization process in Rwanda in general and Nyamata in particular is an important asset to consider **in the progress** towards the realization of a community driven network. In its fundamental essence, the **overall** decentralization policy calls for individuals and communities to play key roles in the governance of their administrative areas through participation in the decision making as well as **in the support of** social and development activities **that aim to** alleviate poverty in the respective livelihoods.

Around the Nyamata area, a number of organizations such as NGOs, cooperatives, small business incubations and **other kinds** of associations are already operating to address specific issues. Information and Communication Technologies are seen as the missing link to support communication and information sharing within and **beyond** the area.

The more realistic CDN model has to take into account the local context and make sure that the targeted groups and individuals are equally represented in this important undertaking.

The organization chart below results from discussion **with** and input from different stakeholders:

The proposed network governance model will be as follows:

- Governing board made up by community representatives
- Management team headed by appointed business manager with targeted goals
- Small technical team to support both the hub centre and remote access points.

Figure 1 – Illustration of a governance model of the network

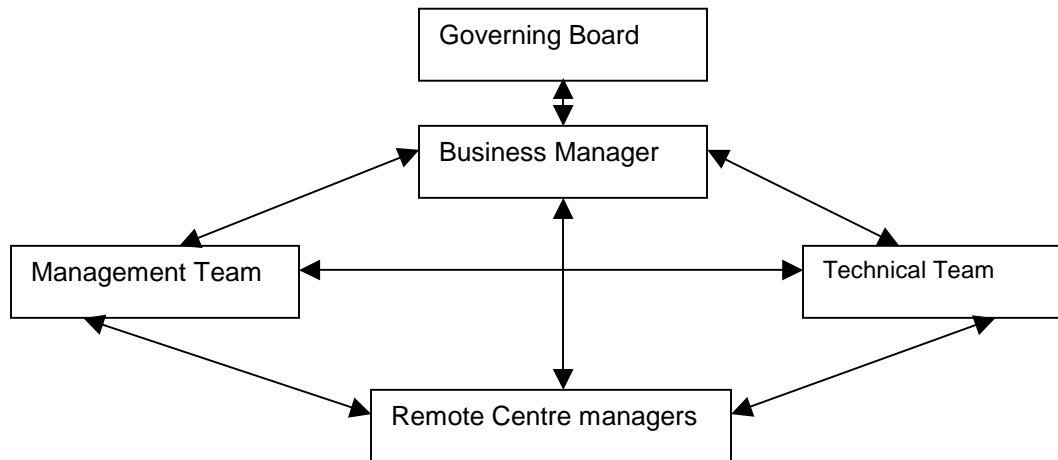


Table 3 – Increase of international bandwidth from operators’ perspective

Company	2004 (Mbps)	2005 (Mbps)	2006 (Mbps)
RWANDATEL – TERRACOM	8	16	52
MTN Rwandacell	2	4	5.5
ARTEL – New ARTEL	2.5	2.5	2.5 (50 projected by end 07)
ISPA	*	*	3
TOTAL	12.5	22.5	63

Source: Desk Research – Data from Telecom Operators and RURA.

* ISPA was launched in 2006.

2.7 Benefits of the community driven model versus purely private sector model

Community participation in the management of the facility has three major goals:

- Ensure access and affordability of services within the network and from the network to other locations;
- Ensure a participatory mechanism in the decision making process for ownership and sustainability purposes;
- Advocate for the CDN’s role in supporting social and economic activities thus poverty alleviation;

The above goals can not be achieved if the network is purely private owned. In essence, the private sector always seeks profit no matter how many people access the network nor how the network impacts the living condition of the community.

2.8 Roles of various local actors

The major groups to support and manage the CDNs are the ones that have already initiated some models of collaboration in the area. Obviously the local government has a key role in terms of facilitating initial discussions within the community for the establishment of the CDN and providing initial logistic support such as a housing facility. Its role will also be to advocate for support from the central government and other development partners because the CDN has to be seen as a local initiative owned by the community. Other groups from different organizations will participate based on their respective expertise. For example, the business community will be useful in helping the CDN in its financial management aspects as well as in its accessing small loans for individuals to acquire phones and other devices that are needed to access and enjoy the network services. The education community may help to build capacity and awareness in potential users within the community while the health group and other associations that promote specific public interests may use this network facility and tools to reach out to the community.

2.9 The technology level

Taking into account the CDN's primary goal to reduce the gap in ICT access and usage in the under-served marginalized areas that are characterized by high illiteracy, low level income and shortage of basic ICT infrastructure such as power and connectivity, the choice of technology is a critical issue as it will determine the sustainability of this whole undertaking over time. The critical question remains: how best can the CDN identify various technologies needed that respond to local conditions?

Preliminary findings from the technical assessment suggest that voice services instead of Voice over Internet Protocol may be the first priority in the area. On top of this, the deployment of wireless local loop and the usage of traditional phone sets with VoIP adapters will help to increase penetration and lower the cost of usage. To reduce the ownership cost and expand access, the use of PC based services and applications should be deployed in a shared environment such as in schools, health centres, and public information centres.

Connectivity from the CDN to the main national backbone outside the network is a critical issue to consider as it will determine possible expansion of the CDN to other locations. Discussions are underway with the regulator and main public telecom operators to seek subsidized prices of access to the backbone from the CDN and more importantly, to apply a cost-based asymmetrical termination charge between the CDN and urban areas.

2.10 Needs of this model and its challenges:

2.10.1 Human resource and capacity

We envision a CDN as an enterprise in the form of a community based cooperative that provides ICT services but also generates more income, and offers other types of services related to ICT. The CDN as a cooperative will have some commonalities with a number of other cooperatives, especially in its governance, but also will have some unique specifics and targets that must be considered during its business plan development.

On the supply side, the CDN requires some level of business and managerial skills as well as technical skills that are likely not available in Nyamata area. Therefore, it is critical to identify ways of building a variety of local expertise, as stated above, to make sure that the CDN does not rely on people that are based outside the Nyamata area.

On the demand side, both the beneficiaries (access points) and end users need specific training to be fully prepared to effectively and efficiently utilize the proposed services. The key success factor is for the community, and individual in particular, to acquire information and knowledge and then apply it the various sectors of intervention with the hope that it will address poverty issues.

2.10.2 Technology needs

As mentioned above, technology is a critical component to achieve the CDN goals and objectives. A variety of technologies from the supply and demand sides will be needed to support the launch, development and expansion of the CDN. **Critical factors to take into consideration while selecting suitable technologies and designing the CDN technical set-up include cost implications, capacity of usage, scalability and power consumption..**

2.10.3 Financial needs

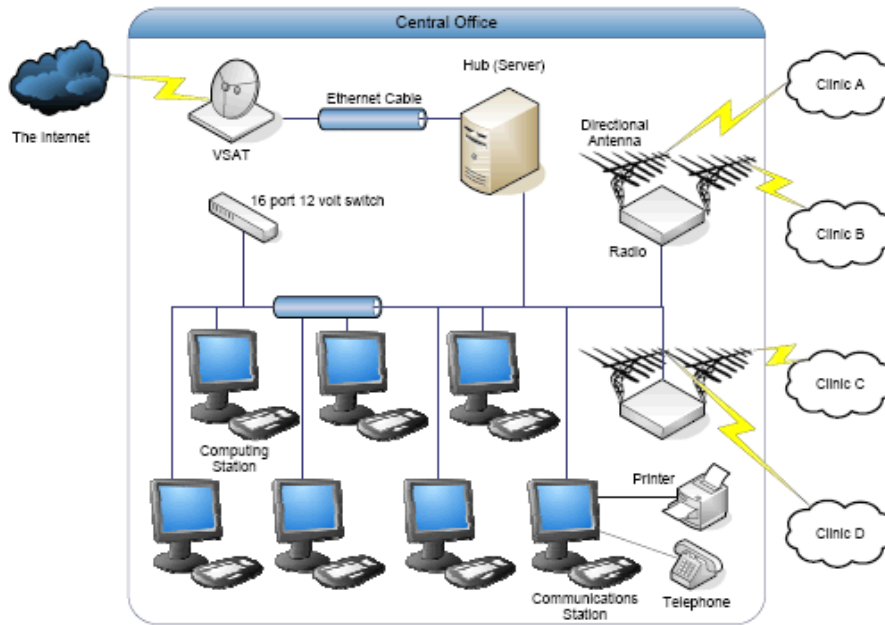
The potential for the CDN to attract start-up funding is being discussed among the main stakeholders including the Rwanda Information Technology Authority (RITA), the Rwanda Utility Regulatory Agency (RURA) and a few development donors that have specific interests in supporting rural transformation. The stakeholders have suggested that further studies are undertaken and technical and business plans developed within an overall implementation proposal that would include options to set up more than one CDN depending on the availability of funds. **In addition, they have suggested that the governance model must be realistic in the local context and that sustainability measures must articulate possible phase out strategies so that the CDNs can be sustained with little financial external support.**

2.10.4 Regulatory needs

The undertaking of CDNs implementation within the country requires a number of regulatory measures to support a smooth establishment and expansion of CDN based enterprises around the country. The important ones include:

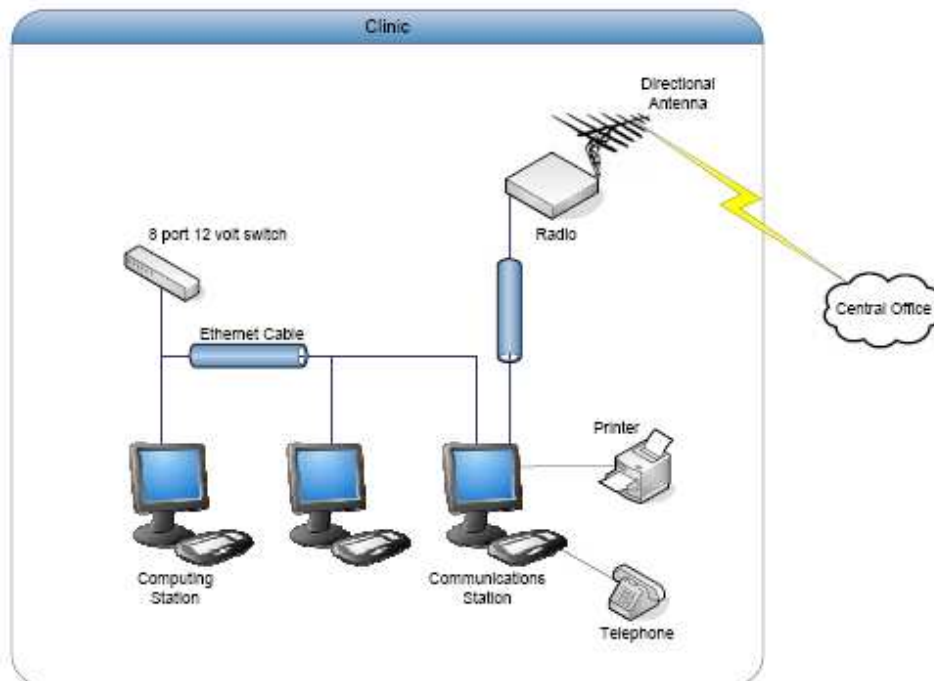
- Promote small scale ICT Enterprises in remote areas through incentives such as no-fee licensing as well as financial support as start-up investment;
- Apply cost based asymmetrical termination charges between CDN and major national operators;
- Enable wireless regulations;
- Stimulate backhaul development in rural areas with public-private funding;
- Enforce a shared infrastructure regulatory policy to allow small players in the rural areas to access network backbone at a cost based price.

Figure 2 – The Hub Station “Hub (Server)” located at the Central Location



**The number of directional antennas shown is not an exact number, only a representation.

Figure 3 – A typical village office location



2.11 Illustration of a community driven network technical set-up – Inveneo technical proposal

2.11.1 Central office location (see Figure 2)

The Hub Station “Hub (Server)” located at the Central Location provides the following functions for the network:

- It acts as the gateway to Internet and PSTN services (note: PSTN connectivity not noted in diagram).
- It houses software Central Location based PBX, known as an IP-PBX, which acts as the call manager for the Central Location and the Village Office Locations. It is the same type of system, which operates in many enterprises and provides extensions, call routing, etc. among the offices over the Local Area broadband Network (LAN). The technology used for this inter-office connectivity is VoIP. If there is a call placed beyond the LAN, as noted above, the call reverts to a standard PSTN type call and is routed to a local PSTN network.
- It acts as a firewall, content management system and file server.

Each of these entire networks can be solar-powered with a battery back-up system.

2.11.2 Village Office Location (see Figure 3)

The following equipment is typical for a Village Office Location (VL) which is noted here as a clinic. The number of computers and antennae required varies for each project.

Each Village Office Location is connected to the Central Location via long distance WiFi Local Area Broadband Network. This enables them:

- Access to a 11 Mbit/s broadband network among the other HFs and the CO.
- Connectivity to the Internet via the Central Location connection to the Internet
- Telephony (VoIP) between the CL and the other VLs
- Access to domestic and international calling via the Central Location connection to the PSTN.

Also, multiple locations can be connected in a village area using a slightly different wireless (WiFi) technology that is designed for shorter distances. Those locations may include just a single wireless phone using VoIP technology.

Each entire network can be solar-powered with a battery back-up system.

3.0 Conclusions

The community driven network model is a new concept in the region and therefore requires piloting to make sure that key lessons and experiences can be garnered before expanding to other locations. A pre-implementation phase before the launch of the pilot is critical to allow for awareness raising within the community and completion of technical studies and assessment.

As we have seen from the case study presented earlier, the cornerstones of any pre-implementation include the following:

3.1 Community focus

The community should be the starting point **and main focus** of any project. There needs to be a large emphasis on awareness and advocacy activity within the community and at the national level. This **must be achieved** through public media, workshop and individual meetings targeting decision makers from public and private sectors.

3.2 Profitability Analysis

To ensure sustainability in the long term, great care must be taken to properly assess the market. Assessments that include services and income in the area, as well as a more traditional business plan analysis are needed. The local community of Nyamata town **needs to be included** to make sure that service prices are affordable and that the representatives of the community own the process.

3.3 Energy Requirements

The next component is a technical study on the most suitable power supply either from **the** public grid, solar energy or other renewable sources depending on the location. The costing of energy over time should also be integrated in the business plan for sustainability purposes.

3.4 Connectivity Feasibility

Finally, **taking** costing/pricing and local purchasing power into consideration, a technical study must be conducted that takes into account connectivity options in the area as well as gateway options to connect to the national backbone.

With all these elements in place, and with the proper support and technical partnerships, the rural community should be well on its way to implementing an appropriate, sustainable and hopefully profitable method of gaining access to information using the CDN model.

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