A ‘C’ in CDN: Access service to and from the Internet at cost for community networks

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Abstract: Community networks have proven reliable, resilient, and cost effective. However creative their deployments, the transit and Internet service costs present obstacles outside of their direct control. This position piece argues that CDNs today are inherently set up to offer transit-like and Internet services, and at no more than at-cost, because the incentives have natural alignment. This piece also shares insights from a global deployment for corporate social good, and asks questions for the future.

Community networks have emerged in every region of the planet as an essential component in ensuring equitable Internet access for all. Community networks emerge from a need to provide Internet access in places that are difficult to reach, or that have economies of scale that conflict with operating models of large and incumbent providers. The reason they can succeed is because they can be so different and, being based in the community, are able to meet the unique demands and environmental challenges of their communities, both in terms of technology and infrastructure, but also business organization and operation.

Once local infrastructure is deployed, there are two key barriers to setting up community networks: the cost and management of transit services and the management overheads associated with backhaul infrastructure. While community-driven solutions can address the cost of backhaul by aggregating the demand of nearby communities [1] and there exist repeatable design patterns to launch and operate local and backhaul infrastructure, there are none for Internet transit and services that vary around the world. Moreover, transit and Internet services from established providers is prohibitively expensive if it is reachable. One natural solution should exist in National Research and Education Networks (NRENs), however these can be hampered by limited budgets, available resources, or bureaucracy.

This position piece instead argues that content delivery networks (CDNs) are well suited to fill transit service gaps for community networks. The position is motivated by two observations.

1. Technical reasons CDNs could service community networks

CDNs and related services are not themselves Internet service providers (ISPs), but they are well-connected networks that establish and maintain their own Internet routing services, with the following set of attributes:

- Internal-facing services -- CDNs manage routing and other services within their own infrastructure, potentially with additional security and observability.

- External-facing services -- CDNs have high-quality interconnection with the Internet, often with ISPs and non-transit networks, and manage their own BGP services.

- CDN Scale -- the size of the CDN scales with any or all of the number of customers, services offered, service demand, and physical reach from local to international.

Intuitively, CDNs would appear to only terminate connections in contrast to community networks that predominantly initiate connections. However, CDNs must initiate connections to the outside world to support their own services and employee activity. Thus CDNs are well positioned *technically* to offer routing and services to and from the Internet for community networks.

2. Incentives mean CDNs could service community networks

CDNs may be technically capable of providing transit-like service to smaller networks, but why would they? On appearance, it is not in the best interest of a CDN to do so. On consideration, however, there may be closer alignment in their incentives, as follows.

1. Bigger audience leads to happier customers. The CDN is either its own customer and originates reachable services, or offers reachable services on behalf of its customers. In either case, more Internet users is a greater potential set of clients for CDN customers to serve. This is the “increases revenue” argument.

2. Every additional connection is one less phone call the CDN’s customer has to answer. Many services predate the Internet; for example, government and social services. Such customers must staff people to answer phones and reply to postal mail to service requests that may be satisfied online. This is the “potentially reduces customer costs” argument.

3. Additional pass-through traffic favours the CDN. For large CDNs, the additional traffic generated by the community is likely negligible (e.g.on settlement-free interconnection or 95th percentile pricing for bidirectional traffic); offering service in these cases may also qualify as corporate social responsibility (CSR). Conversely, small CDNs may be able to use the additional traffic to negotiate larger contracts that reduce the individual proportionally shared costs. This is a “mutual benefit” argument.

If incentives are aligned then one question remains: What is the right charging model? Market rates are the reasons community networks have so few options. One example offering described below is no cost within a fixed threshold.

Anecdotal insights from a global deployment

A CDN offering Internet routing and access services can remove a large financial barrier from community network deployments. The following insights taken from a large global CDN offering [2,3] may inform future designs or design patterns.

- Community networks still need backhaul to and from the CDN's point of presence. While Internet services via CDNs does not in itself solve the backhaul problem, having options available for affordable services can only incentivize the otherwise missing infrastructure. Models for community-backhaul do exist [1]. This model reinforces a need to decouple the backhaul and transit services that are so often tied together.

- For backhaul, the CDN may need permission to mount equipment on a building's exterior, for example, to mount a wireless antenna or create an entry point for a cable.

- Community networks likely need their own IP address space. A CDN may be technically unable, or unwilling, to share its own IP address space with community networks that connect through it. In this case either the CDN must dedicate IP space, or the community network must bring its own, which is complicated by the scarcity of IPv4 address space.

The costs incurred by the CDN to provide this service are non-zero. Referring back to incentive 3. above, an at-cost service offering could budget support costs into its cost models. For larger zero-cost offerings, the support costs may be fit with institutional corporate social responsibility (CSR) programs [4,5]. For smaller operations, non-zero costs suggest potential opportunities for community-oriented CDNs, left as an open question.

Closing Remarks and Open Questions

Transit and Internet service costs exceed what community networks can afford. CDNs are well positioned to reduce, even eliminate, those costs for mutual benefit, as evidenced by a global deployment.

Looking ahead, if the proposed model proves effective then two questions immediately emerge. First, is there a need for the IETF or similar to decide interfaces or best practices? Ideally, CDNs may use open standards but they may not, in which case interoperability is harder to achieve. Some CDNs will find it more or less difficult to isolate community network traffic from their own, and this may be a consideration for future.

In addition, if the community models and incentives align with CDNs, then is there space for a community-owned and operated CDN? Community-driven models succeed in delivering local network services, and more recently for backhaul (and transit) services [1]. A community-CDN would appear to be a logical extension. This is left for future discussion and investigation.

References

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