fast facts

Project: The AirJaldi Bandwidth Maximizer
Lead Organization: AirJaldi
Country: India

situation

The main obstacle facing network operators in rural areas of developing countries is the low economic viability of setting up broadband Internet networks using expensive commercial technologies to reach relatively few and dispersed users. The typically high cost of Internet upstream bandwidth in such areas adds significant challenges. Further, frequent upstream congestion and long hours of total service downtime - often resulting in slow, limiting, and erratic service - are common.

solution

In order to address both cost and availability, one of the necessary conditions for ISPs operating in such areas lies in finding ways to ensure uninterrupted Internet connectivity and maximize the utilization of available bandwidth with minimal impact on the end user's experience. The AirJaldi Bandwidth Maximizer (BwM) project was designed to develop a prototype bandwidth maximizer to run on the AirJaldi Network in Dharamsala.

Traditionally, bandwidth optimization is confined to the low network layers to avoid any negative effect on user data. While this is the traditional approach, the project team found that in order to increase the number of users on a severely bandwidth-constrained network, it was necessary to reduce the bandwidth consumption by interfering with content. To resolve the conflict between quality and content trade-off, the team researched network traffic trends on the Dharamsala network and analyzed end-user needs. Based on these, plus a close examination of a number of tools commonly used for network management and bandwidth management in particular, the AirJaldi team focused work primarily on four related areas: content caching, content compression, virus and malware protection, and load balancing of multiple lines.

To this end, the team compiled, tested, and improved upon more than a dozen different commercial free and open source software (F/OSS) software and network solutions to create a viable prototype. The team also published extensive documentation and provided resources so that other network providers and ISPs would be able to reproduce their results. Not only does the AirJaldi system provide meaningful bandwidth savings to people located in areas in which internet access is limited, but it is also able to prevent unwanted content from reaching the local network and "clogging" the connection. Content recompression also proved to be very effective, and has been shown to reduce bandwidth consumption for website browsing by as much as half. The team was also able to address the problem of upstream redundancy (information being sent back unnecessarily) by implementing a simple load-balancing solution that does not necessitate the use of expensive hardware or closed source solutions.

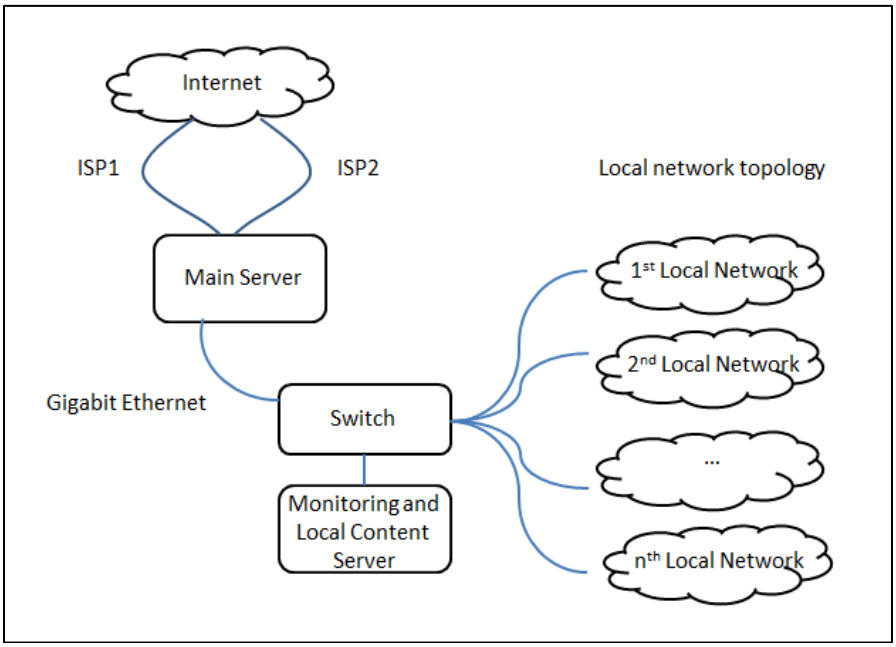
The AirJaldi BwM is presently deployed in Dharamsala and will shortly be deployed in two additional networks in India. More importantly, the product is fully replicable, although familiarity with networking, and F/OSS-based networking in particular, is required. An installation manual was authored for those interested in using the system and will be made available online. Project benchmarks and real-life deployment of the solution show that it leads to considerable bandwidth conservation and can potentially increase the revenue of a rural ISP by about 10%.

broader impact

The products and findings of this project will be of direct use to system administrators of small and medium-size ISPs that are open to using F/OSS network software. The team believes that by putting their findings to practical use on other networks, real gains will be made over a broader area within a short period of time.

Users will also benefit from faster, more secure, and more stable services. The easy-to-use installation manual, which provides detailed instruction on how to deploy the BwM, should further encourage managers of rural ISPs to implement it. Further, with the integration of all the components needed to run on a commodity PC, the team achieved cost reduction to allow future ISPs to start with lower capital costs; as the solution proposed replaces three pieces of equipment – a server, the load balancer, and a router –with a single PC.

The project also contributes to the F/OSS community as a whole. The entire project is based on F/OSS, and the project team has made it a point to contribute to the F/OSS community through bug correction for software used during the project (SQUID and Cacti on Ubuntu) and by enhancing related projects (Mpath) with add-ons developed for this project.



AirJaldi network architecture

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