Local Area Networking at Colorado State University
An Analysis
IAC Communications Infrastructure Committee

Background

A special sub-committee of the ITEC Advisory Counsel (IAC) was constituted in July and tasked with analyzing the campus communications infrastructure and making technical recommendations on designs and support models suitable to take the campus into the next 5-10 years. This committee has been referred to as the communications infrastructure committee (the CIC), and its preliminary recommendations for a campus local area network design are presented here.

Since the first campus networks were deployed in the mid-late 1980s, an extensive fiber optic cable plant has been developed to support the main, south and foothills campuses. The campus backbone network is currently at 1 Gigabit per second (Gbps), or 100 times the bandwidth of the original campus LAN connections. CSU's external connectivity is also currently at 1 Gbps, though there are plans to upgrade both the backbone network and the wide area connection to 10 Gbps in FY10.

In FY02, a chargeback model was implemented to fund the rising costs of networking on the campus (see http://www.acns.colostate.edu/?page=network_charge_back for information regarding this activity). The chargeback algorithm is based on the speed of the connection to the campus backbone network; for each 10x increase in network capacity there is a corresponding 2.8x increase in the annual charge. As explained below, this chargeback model has had the unintended consequence of sub-optimal network connectivity to many campus buildings.

Current Topology

As a result of the above chargeback system, colleges and departments have "value engineered" their network connectivity in order to reduce costs. Figure 1 shows various configurations that have been adopted. While some buildings are attached via a single backbone connection, it is far more common to have several buildings attached to the core campus network via a single connection (typically at 100 Mbps). Indeed, the number of connections to the backbone network has been reduced by 33% since the chargeback mechanism we proposed in 2000. This creates a single point of failure for all buildings sharing that connection, as well as an obvious bottleneck for all users behind the single link to the campus and the Internet. Additionally, when a core campus router fails or is taken down for maintenance, then all buildings serviced by that router are without connectivity to the rest of campus or the Internet until service has been restored.

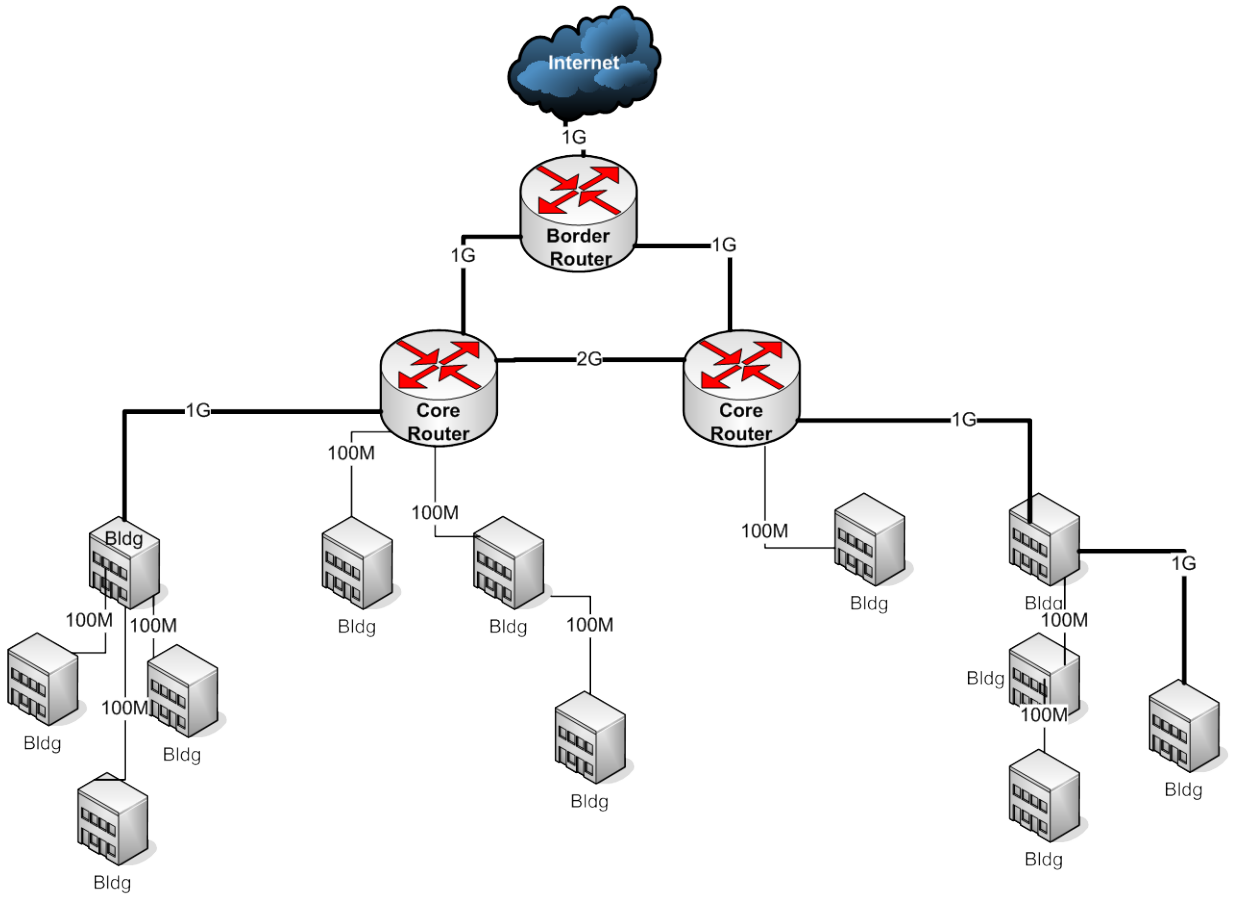

Figure 1. Illustration of current network topologies on the CSU campus, with multiple buildings often behind a single connection to the campus backbone network.

Proposed Topology

The CIC believes that a far more desirable design is illustrated in figure 2, where most buildings would be upgraded to gigabit Ethernet connectivity to the campus backbone. In this design, buildings would have a primary connection to one core campus router and a backup connection to another, adding resiliency as well as capacity. Implementing this type of topology would eliminate single points of failure that could deny access to hundreds of users distributed over multiple buildings, increases uptime and availability by providing redundant connections to the campus backbone routers, and positions the University to accommodate bandwidth requirements of the future. Areas requiring very high-speed access would have the option of upgrading their connection from 1 Gbps to 10 Gbps.

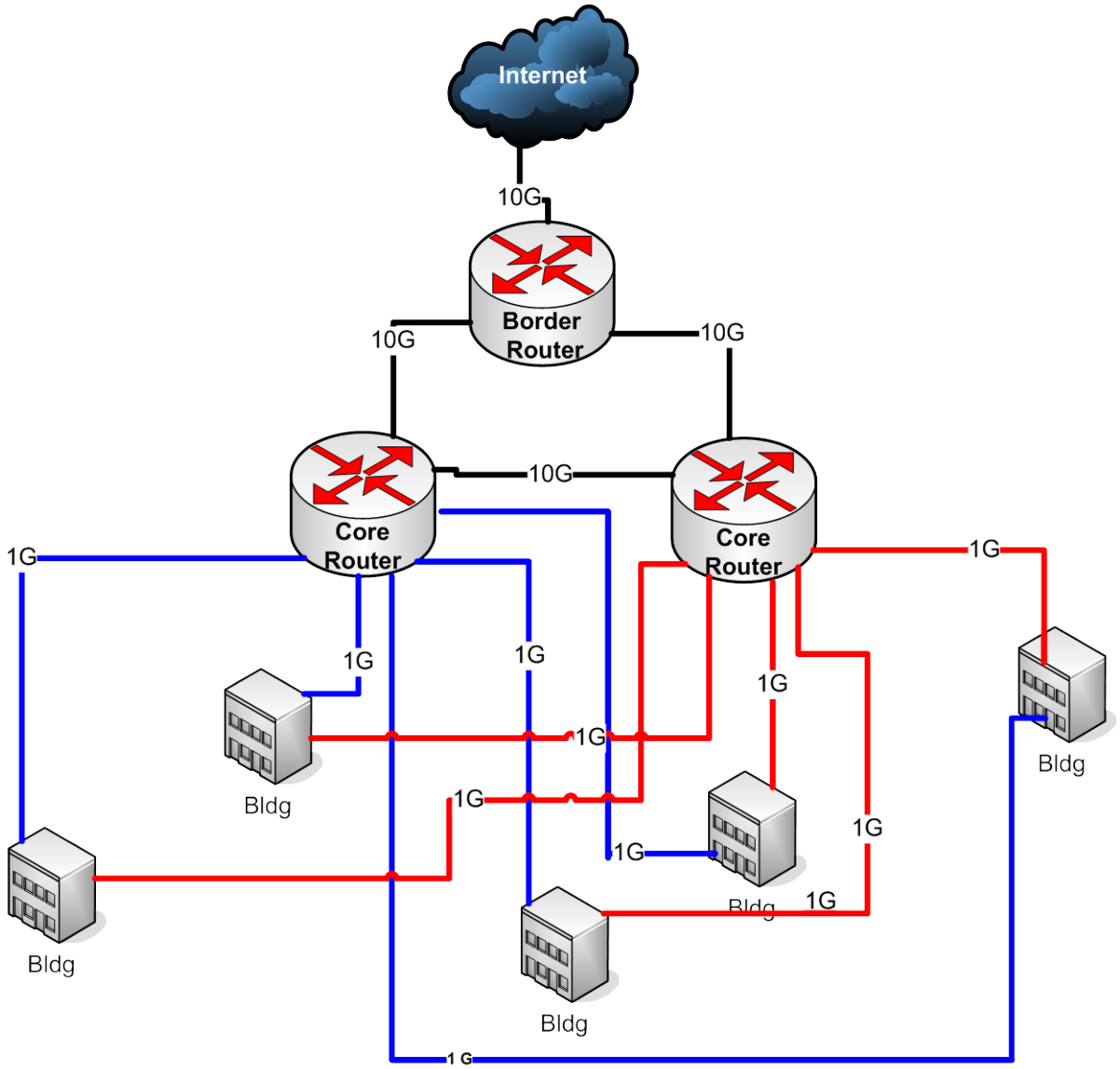

Figure 2. Illustrates a topology where buildings are connected via primary and backup gigabit Ethernet connections.