
Cloud-Enabling Technology

— Cloud Computing —

Dr. Manish T I
Professor, Dept of CSE
SCMS School of Engineering and Technology, Kerala
manish@scmsgroup.org, manishti2004@gmail.com

- Broadband Networks and Internet Architecture
- Data Center Technology
- Virtualization Technology
- Web Technology
- Multitenant Technology
- Service Technology

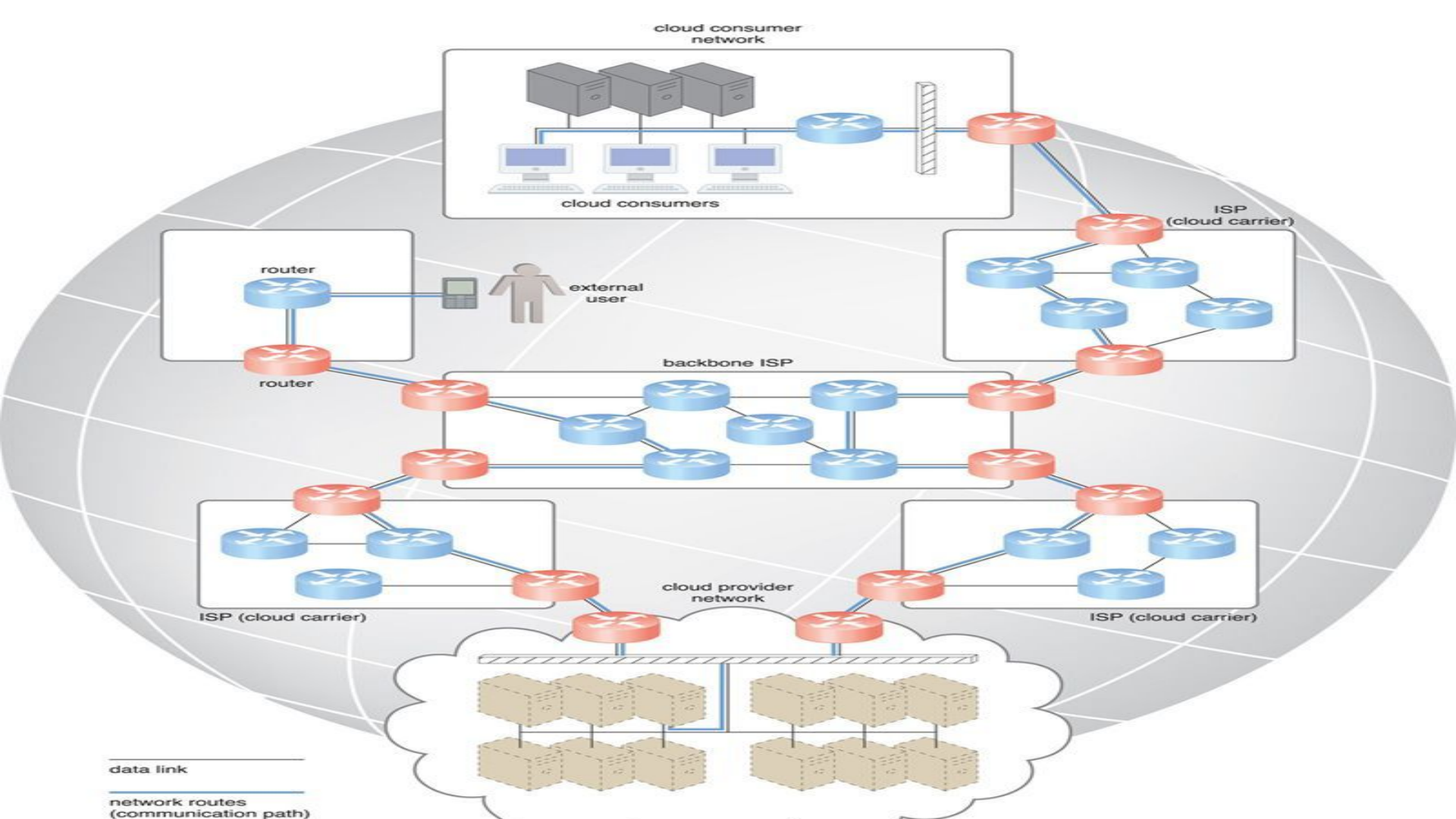
- This inevitable requirement forms an **inherent dependency** on internetworking.
- Internetworks, or the Internet, allow for the **remote provisioning** of IT resources and are directly supportive of ubiquitous network access.
- Cloud consumers have the option of accessing the cloud using only **private and dedicated network links in LANs**
- The potential of cloud platforms therefore generally **grows in parallel** with advancements in Internet connectivity and service quality.

Internet Service Providers (ISPs)

Established and deployed by ISPs, the Internet's largest backbone networks are strategically interconnected by core routers that connect the world's multinational networks.

The concept of the Internet was based on a decentralized provisioning and management model.

ISPs can freely deploy, operate, and manage their networks in addition to selecting partner ISPs for interconnection.

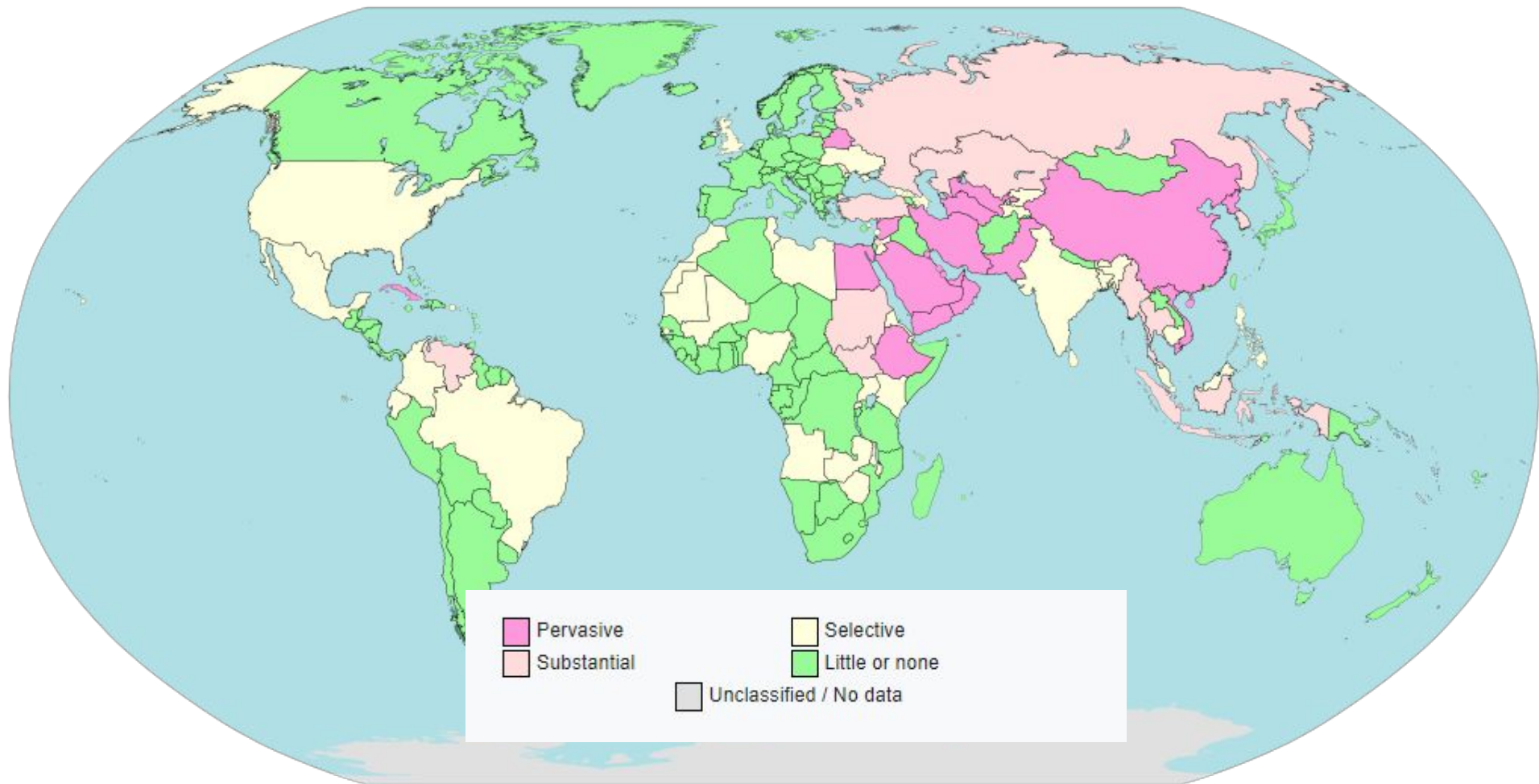


No centralized entity comprehensively governs the Internet, although bodies like the **Internet Corporation for Assigned Names and Numbers (ICANN)** supervise and coordinate Internet communications.

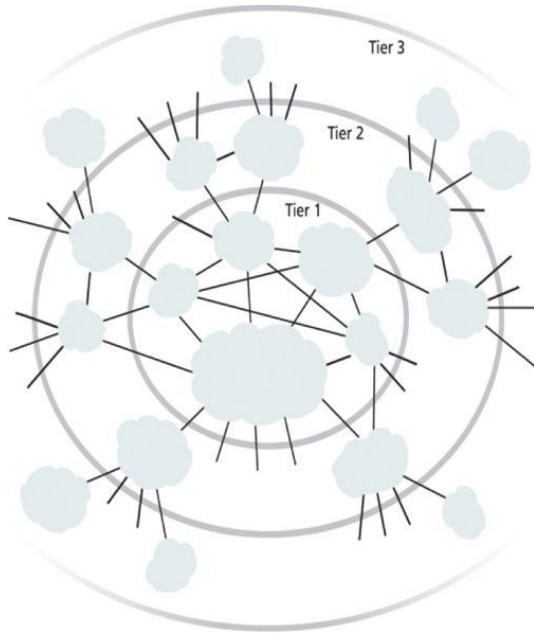
Governmental and regulatory laws dictate the service provisioning conditions for organizations and ISPs both within and outside of national borders.

- Telecom Regulatory Authority of India **TRAI**
- Ministry of Information and Broadcasting **MIB**
- Telecommunication Engineering Center **TEC**

Certain realms of the Internet still require the demarcation of national jurisdiction and legal boundaries.



Worldwide connectivity is enabled through a hierarchical topology composed of Tiers 1, 2, and 3



The core Tier 1 is made of large-scale, international cloud providers that oversee massive interconnected global networks, which are connected to Tier 2's large regional providers.

The interconnected ISPs of Tier 2 connect with Tier 1 providers, as well as the local ISPs of Tier 3.

Cloud consumers and cloud providers can connect directly using a Tier 1 provider, since any operational ISP can enable Internet connection.

The communication links and routers of the Internet and ISP networks are IT resources that are distributed among countless traffic generation paths.

Two fundamental components used to construct the internetworking architecture are

- Connectionless packet switching (datagram networks)
- Router-based interconnectivity

Connectionless Packet Switching (Datagram Networks)

End-to-end (sender-receiver pair) data flows are divided into packets of a limited size that are received and processed through network switches and routers, then queued and forwarded from one intermediary node to the next.

Each packet carries the necessary location information, such as the Internet Protocol (IP) or Media Access Control (MAC) address, to be processed and routed at every source, intermediary, and destination node.

Router-Based Interconnectivity

A router is a device that is connected to multiple networks through which it forwards packets.

Even when successive packets are part of the same data flow, routers process and forward each packet individually while maintaining the network topology information that locates the next node on the communication path between the source and destination nodes.

Routers manage network traffic and gauge the most efficient hop for packet delivery, since they are privy to both the packet source and packet destination.

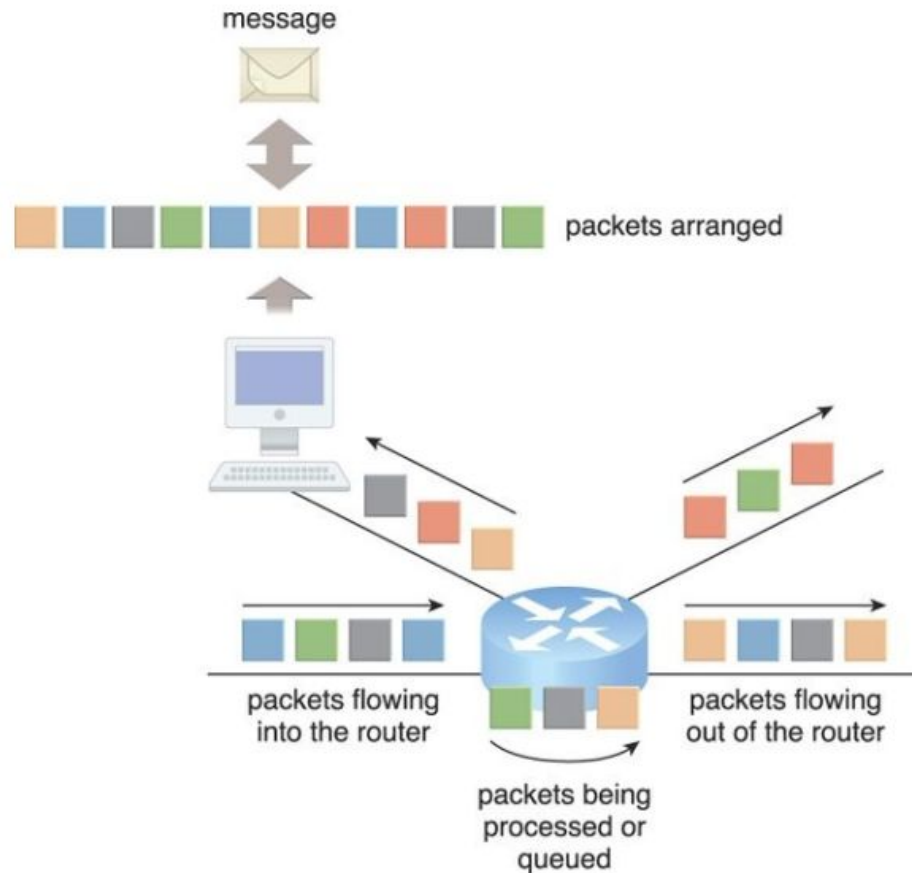


Figure 5.3. Packets traveling through the Internet are directed by a router that arranges them into a message.

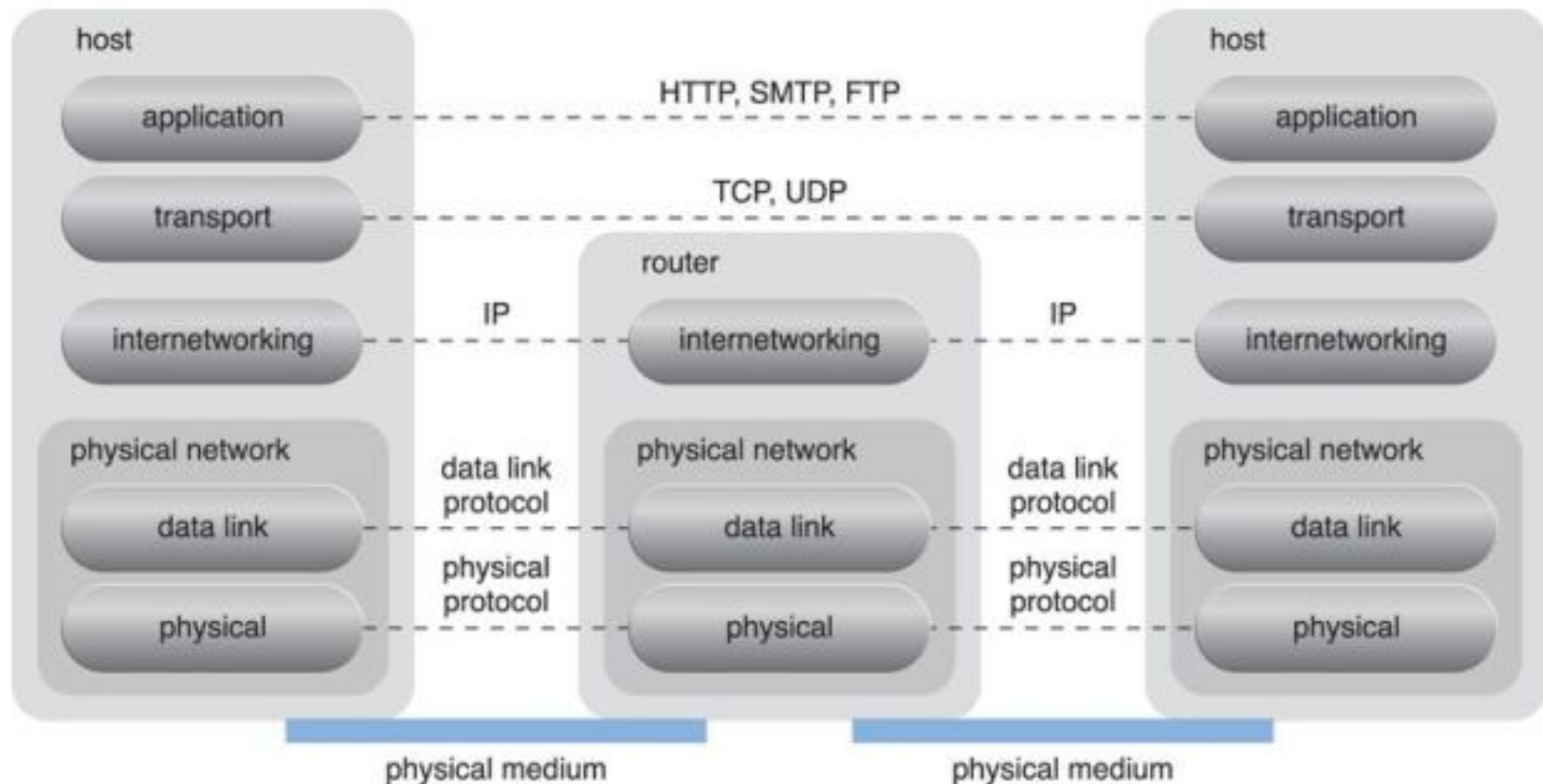


Figure 5.4. A generic view of the Internet reference model and protocol stack.

Physical Network

Data link layer controls data transfer between neighboring nodes

Physical layer transmits data bits through both **wired and wireless media**.

Transport Layer Protocol

Transmission Control Protocol (TCP) and User Datagram Protocol (UDP), use the IP to provide standardized, end-to-end communication support that facilitates the navigation of data packets across the Internet.

Application Layer Protocol

HTTP, SMTP for e-mail, BitTorrent for P2P, and SIP for IP Telephony

Enable specific data packet transferring methods over the Internet.

Technical and Business Considerations

Connectivity Issues

Network Bandwidth and Latency Issues

Cloud Carrier and Cloud Provider Selection

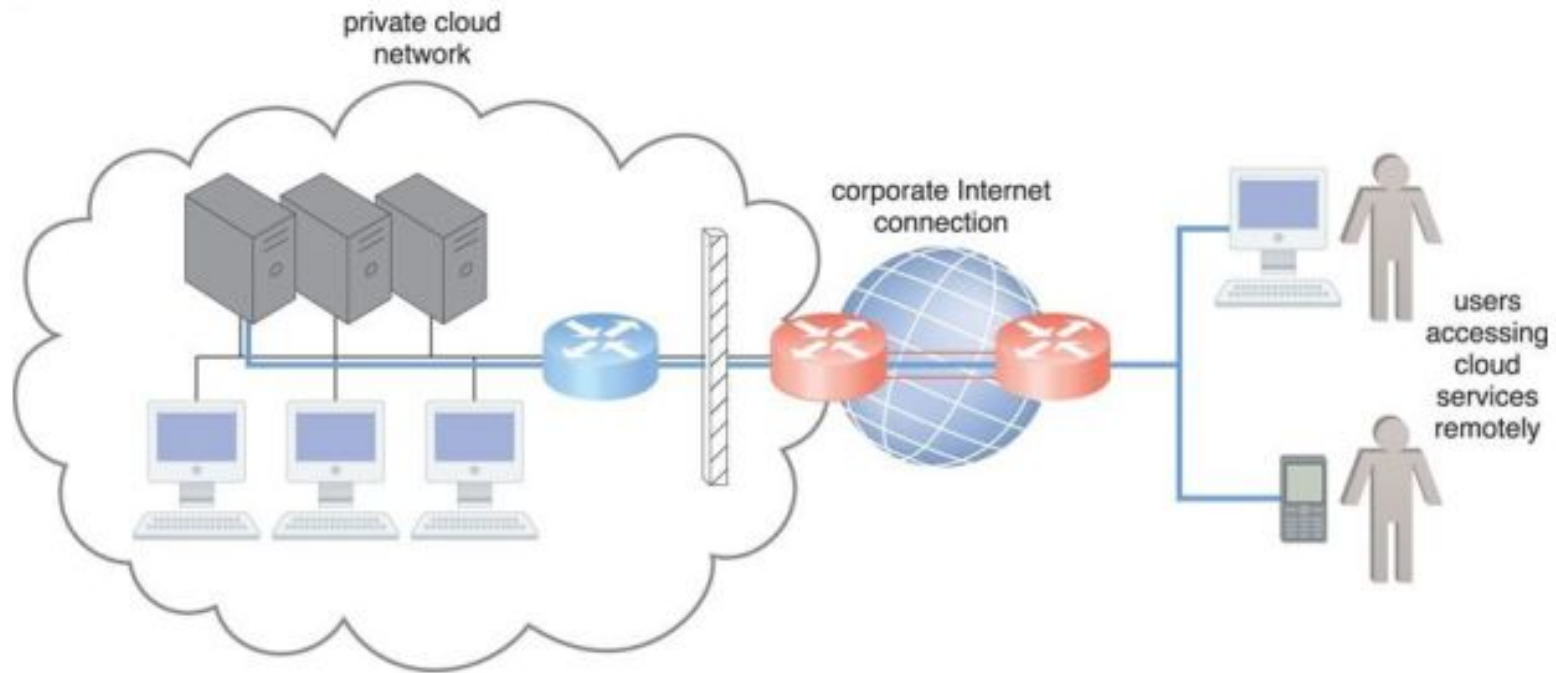


Figure 5.5. The internetworking architecture of a private cloud. The physical IT resources that constitute the cloud are located and managed within the organization.

Table 5.1. A comparison of on-premise and cloud-based internetworking.

On-Premise IT Resources	Cloud-Based IT Resources
internal end-user devices access corporate IT services through the corporate network	internal end-user devices access corporate IT services through an Internet connection
internal users access corporate IT services through the corporate Internet connection while roaming in external networks	internal users access corporate IT services while roaming in external networks through the cloud provider's Internet connection
external users access corporate IT services through the corporate Internet connection	external users access corporate IT services through the cloud provider's Internet connection

Data Center Technology

Modern data centers exist as specialized IT infrastructure used to house centralized IT resources, such as servers, databases, networking and telecommunication devices, and software systems.

Data centers are typically comprised of the following technologies and components:

- Virtualization
- Standardization and Modularity
- Automation
- Remote Operation and Management
- High Availability
- Security-Aware Design, Operation, and Management