CIS 375
CHAPTER 12

Network Management

Outline

- What Do Network Managers Do?
- Designing for Network Performance
- Network Management Standards
- Managing Network Traffic
- Configuration Management
- Performance Management
- End User Support
- Cost Management
- Implications for Management

Network Management

- **Network management** is the process of operating, monitoring, and controlling the network to ensure it works as intended and provides value to its users

What Do Network Managers Do?

Operational Tasks

- Manage the day-to-day operations of the network
- Provide support to network users
- Ensure the network is operating reliably
- Evaluate and acquire network hardware, software, and services
- Manage the network technical staff
- Manage the network budget, with emphasis on controlling costs

What Do Network Managers Do?

Strategic Tasks

- Develop a strategic (long-term) networking and voice communications plan to meet the organization's policies and goals
- Keep abreast of the latest technological developments in computers, data communications devices, network software, telephone technologies, and the Internet
- Assist senior management in understanding the business implications of network decisions and the role of the network in business operations

Designing for Network Performance

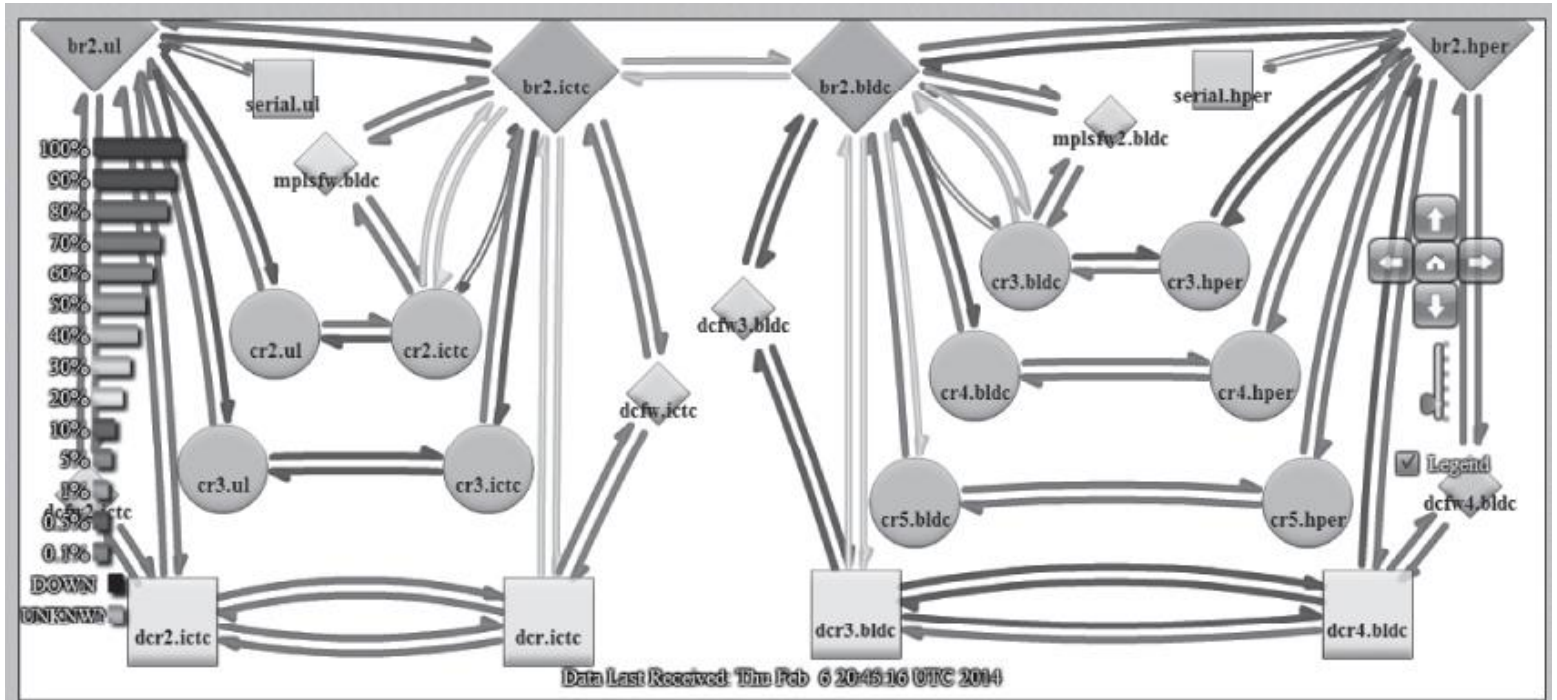
- Managed Networks
  - Managed devices
    - Provide the features of unmanaged devices, plus the ability to configure, manage, and monitor the device
    - More expensive initial investment, but may save money in management
    - Can report when issues arise

Designing for Network Performance

- Device management software (point management software)
  - Allows manager to monitor performance and configuration of devices on network
- System management software
- Application management software

Designing for Network Performance

FIGURE 12-1 Device management software used on Indiana University's core backbone network.



About | Statistics | Circuit Info — Statistics

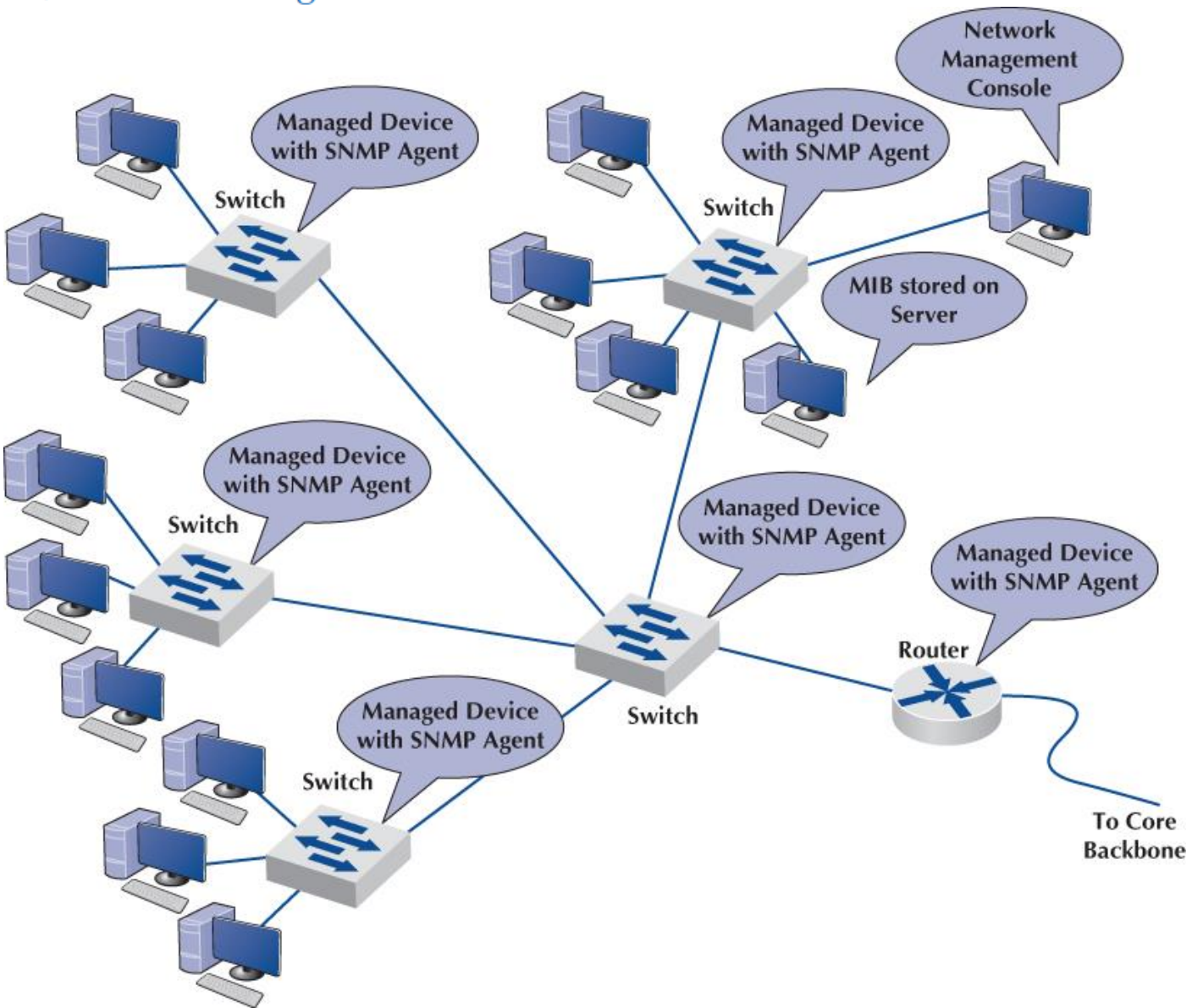
Circuit Name	A -> Z	bits/sec		Packets/sec		Errors/sec	Z -> A	bits/sec		Packets/sec		Errors/sec
IU-ICTC-ICTC-LSP-03670	ictc -> ictc	388.37	Mbps	47.08	Kpps	0	ictc -> ictc	328.49	Mbps	45.44	Kpps	0
IU-ICTC-ICTC-LAG-03607	ictc -> ictc	37.3	Kbps	40	pps	0	ictc -> ictc	41	Kbps	44	pps	0
IU-HPER-bldc-LAG-03647	bldc -> hper	7.59	Mbps	1102	pps	0	hper -> bldc	178.96	Kbps	135	pps	0
IU-HPER-BLDC-10GE-03684	hper -> bltn	3.96	Mbps	611	pps	0	bltn -> hper	15.61	Mbps	2060	pps	0
IU-ICTC-ICTC-LAG-03673	ictc -> ictc	10.77	Kbps	19	pps	0	ictc -> ictc	8174	bps	16	pps	0
IU-UL-UL-LAG-03656	ul -> ul	64.47	Mbps	7568	pps	0	ul -> ul	19.13	Mbps	4423	pps	0
IU-ICTC-UL-LAG-03659	ul -> ictc	12.2	Mbps	2586	pps	0	ictc -> ul	38.2	Mbps	7009	pps	0
IU-ICTC-UL-LAG-03674	ul -> ictc	3045	bps	4	pps	0	ictc -> ul	4090	bps	6	pps	0
br2.ul.net.uits.iu.edu--ge-3/0/1	ul -> ul	1.12	Mbps	225	pps	0	ul -> ul	353.68	Kbps	153	pps	0
IU-ICTC-ICTC-LAG-03675	ictc -> ictc	3.32	Gbps	361.51	Kpps	0	ictc -> ictc	2.37	Gbps	385.39	Kpps	0
IU-ICTC-ICTC-LSP-03669	ictc -> ictc	339.42	Mbps	46.3	Kpps	0	ictc -> ictc	402.58	Mbps	47.96	Kpps	0
IU-bldc-bldc-MPLSLSP-03667	bldc -> bldc	3310	bps	7	pps	0	bldc -> bldc	3137	bps	7	pps	0

Network Management Standards

- **Simple network management protocol (SNMP)**
  - Most commonly used protocol for managing network devices
  - The network management software uses SNMP to communicated with software **agents** on managed devices
  - Data is stored in **management information base (MIB)**

Network Management Standards

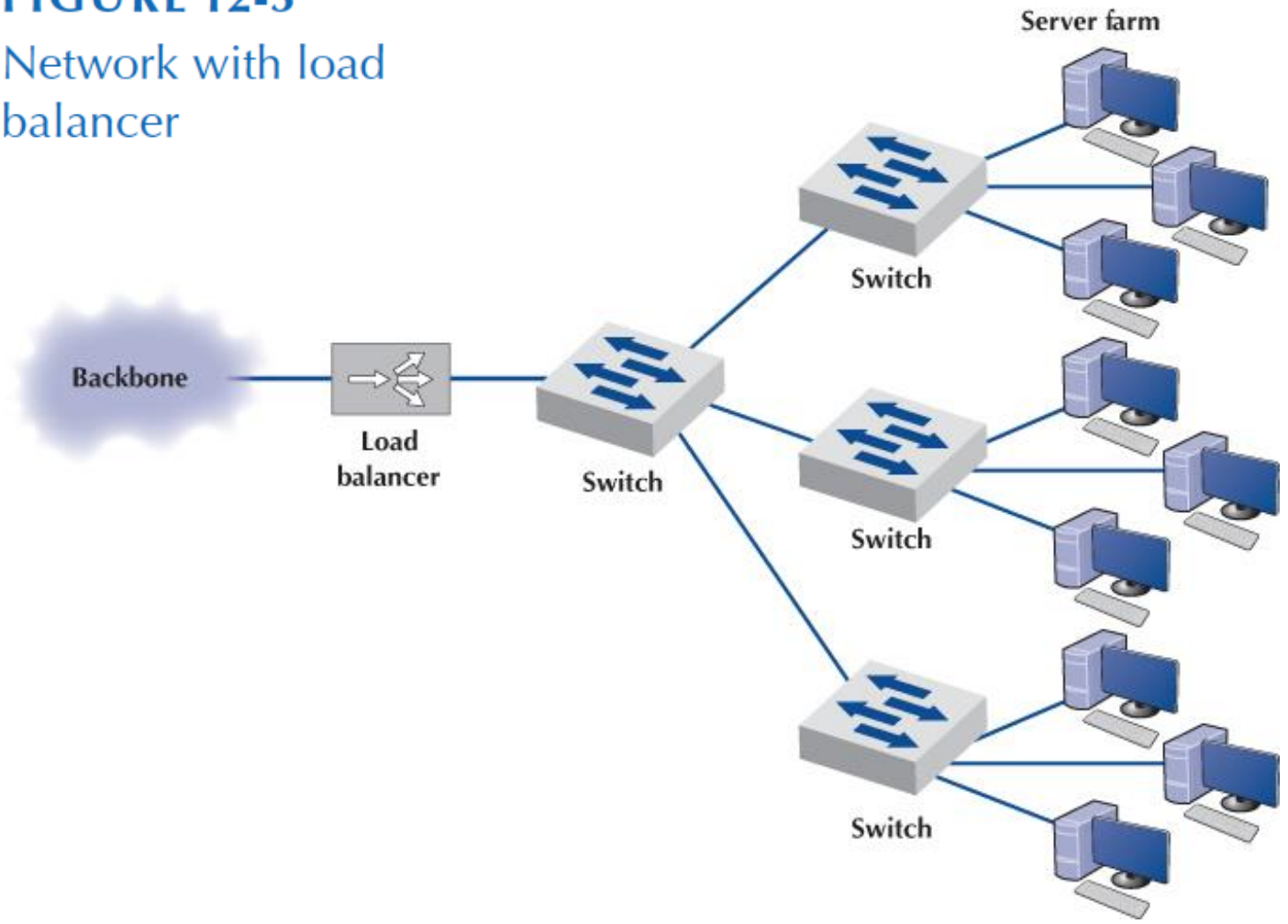
FIGURE 12-2 Network management with Simple Network Management Protocol (SNMP). MIB = management information base



Managing Network Traffic

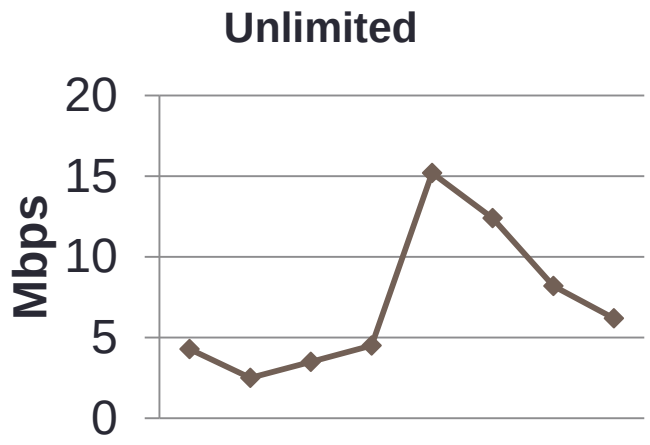
- Load balancing
  - Spreads traffic to devices in server farm (or cluster)

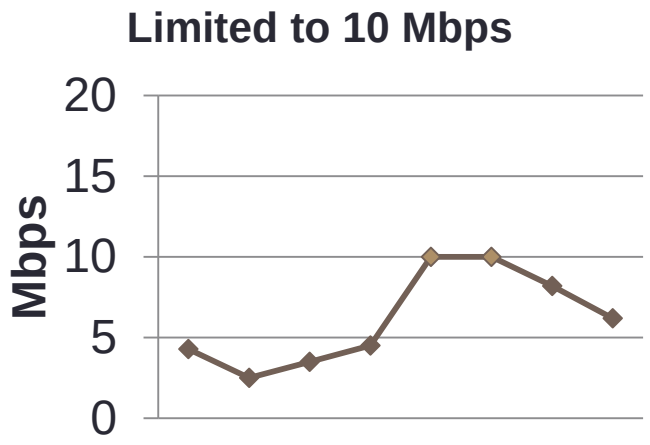
FIGURE 12-3
Network with load balancer



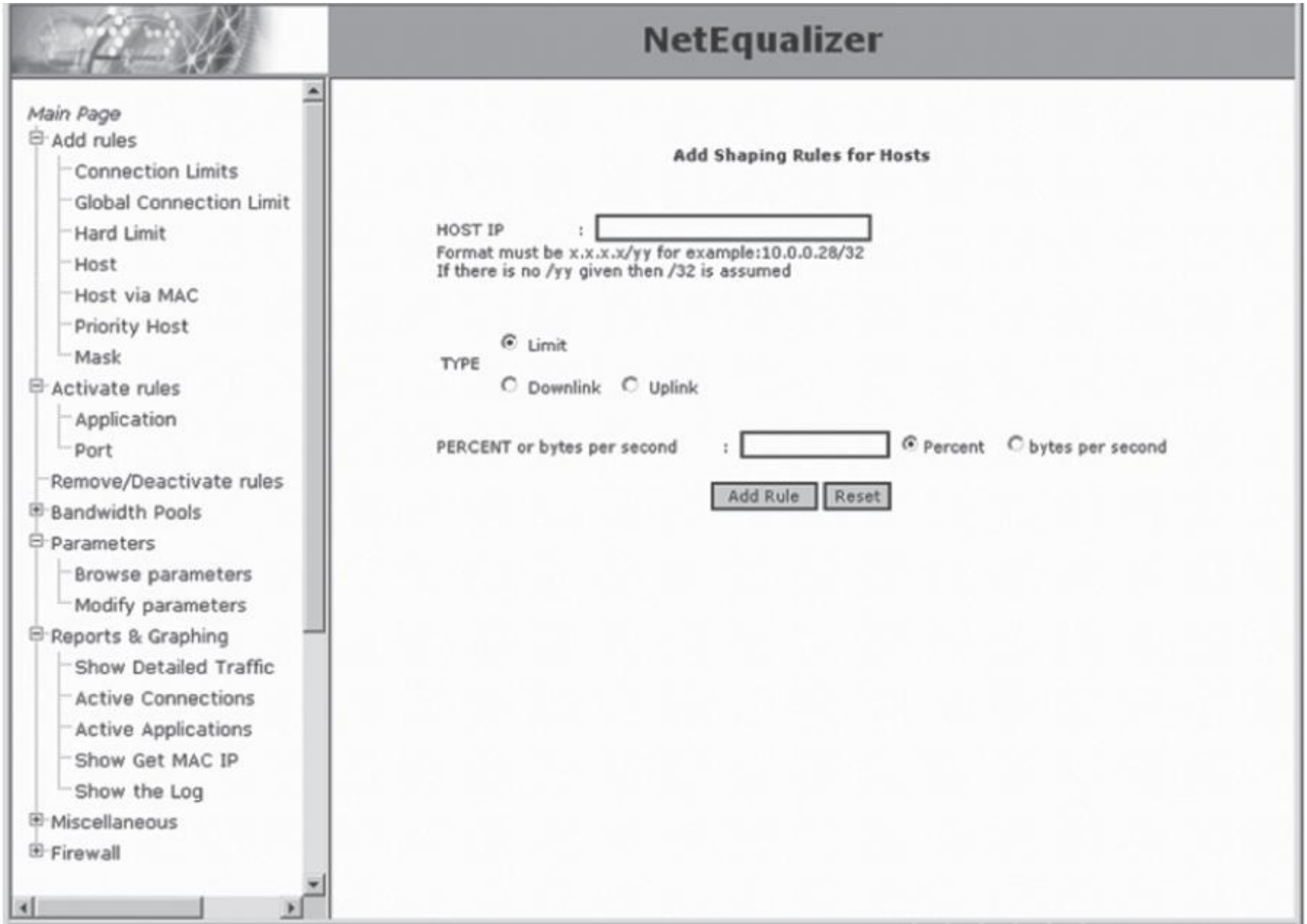
Managing Network Traffic

- Traffic shaping
  - By protocol or application
    - Blocking or limiting similar to quality of service (QoS)
  - By source/destination
    - Limiting bandwidth for some users





Managing Network Traffic



Managing Network Traffic

- Content Caching

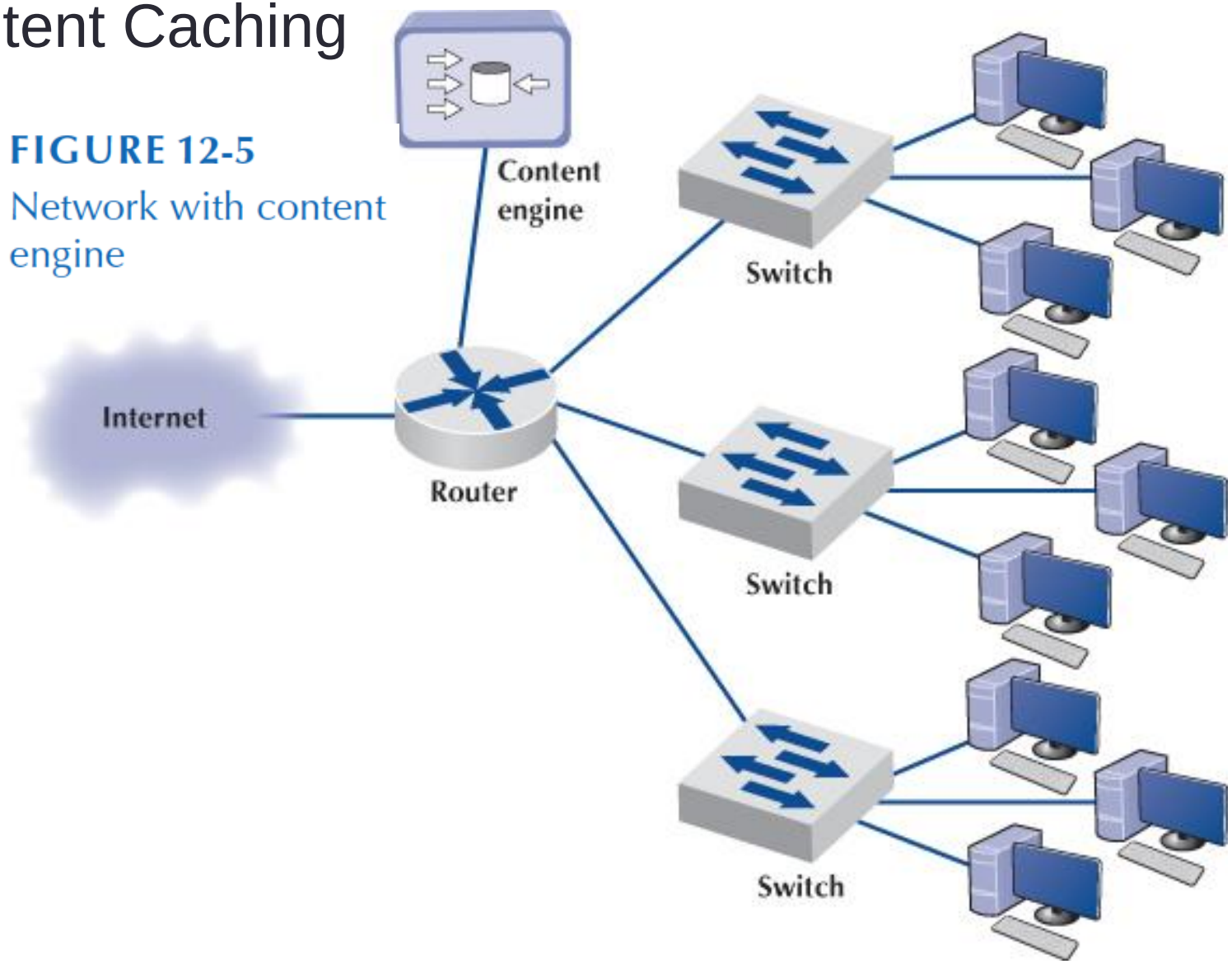


FIGURE 12-5
Network with content engine

Managing Network Traffic

- Content delivery (or distribution) network (CDN)
  - Serve content from servers closest to request
  - e.g., Akamai

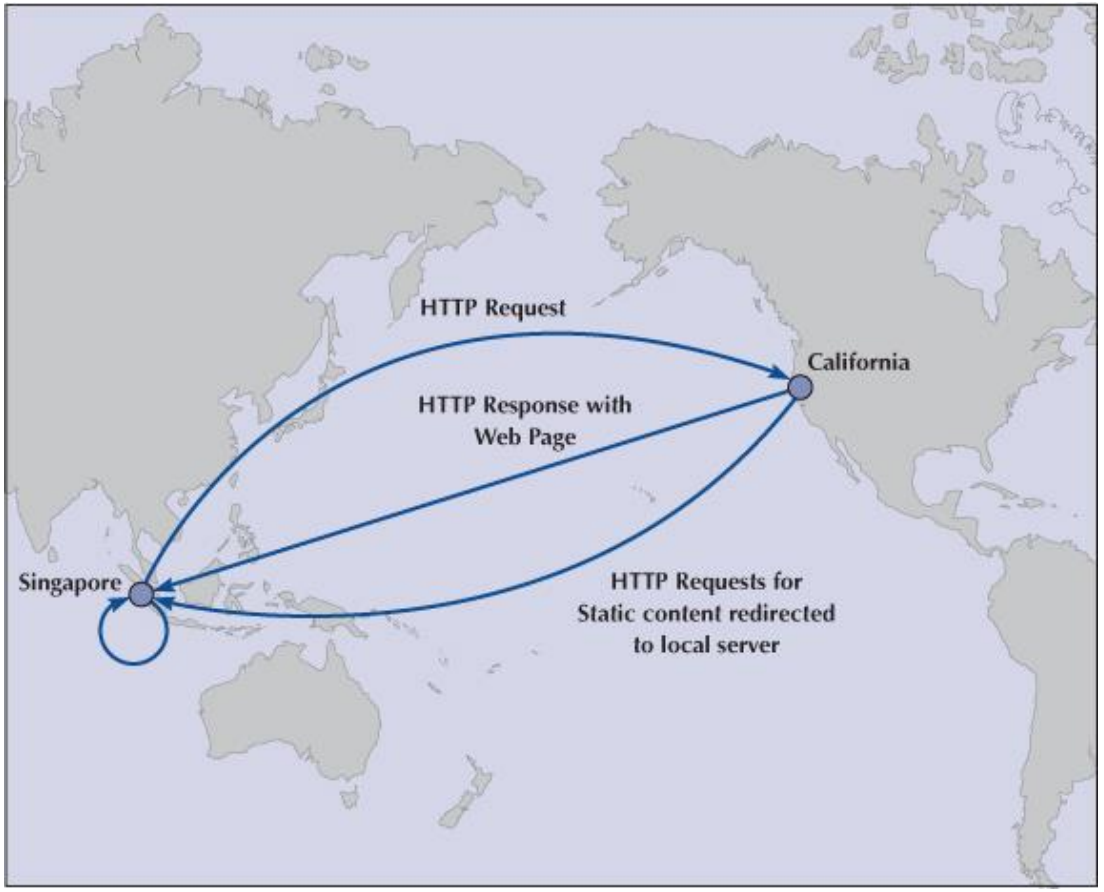
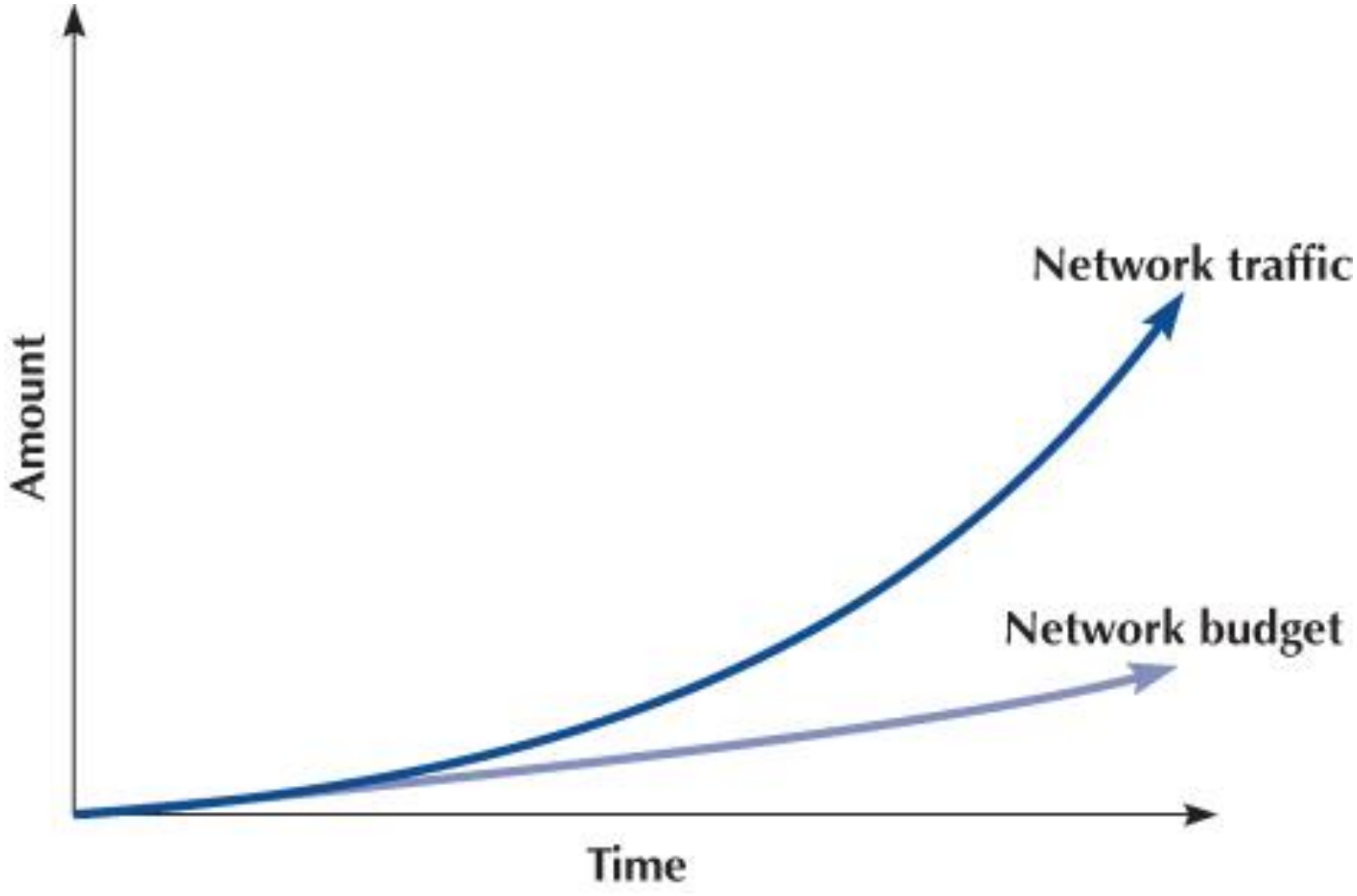


FIGURE 12-6
Network with content delivery

Managing Network Traffic

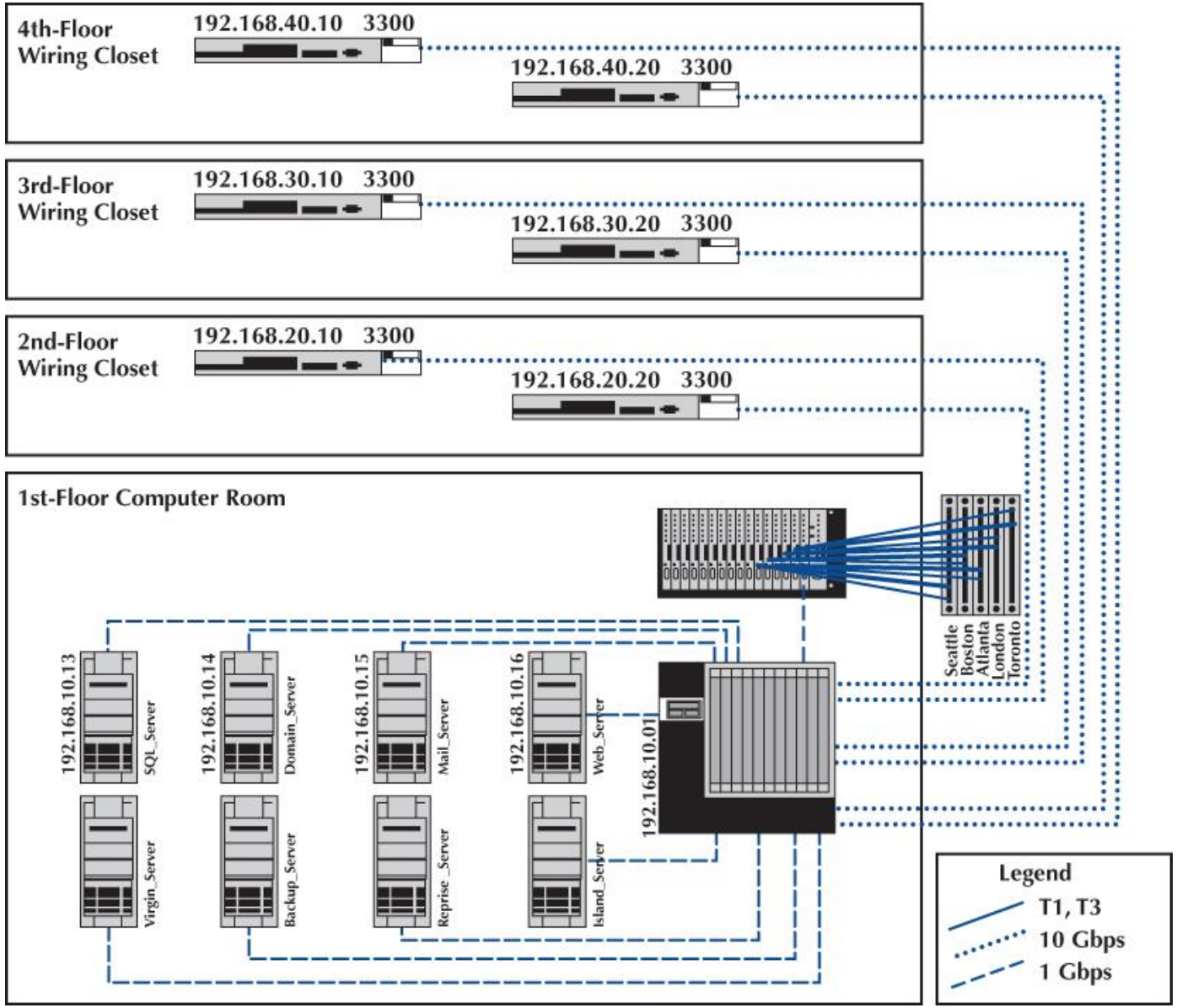


Configuration Management

- Configuring Network and Clients
  - Adding and deleting user accounts
  - Updating software on client computers
  - Desktop Management
- Documenting Configuration
  - Network diagrams
  - Network components
  - Network software
  - User/application profiles

Configuration Management

FIGURE 12-7 Network configuration diagram



Performance Management

- Many organizations use **dedicated network operations centers (NOCs)** to monitor networks using **network management software**

FIGURE 12-8 Part of the Network Operations Center at Indiana University. Photo courtesy of the author, Alan Dennis

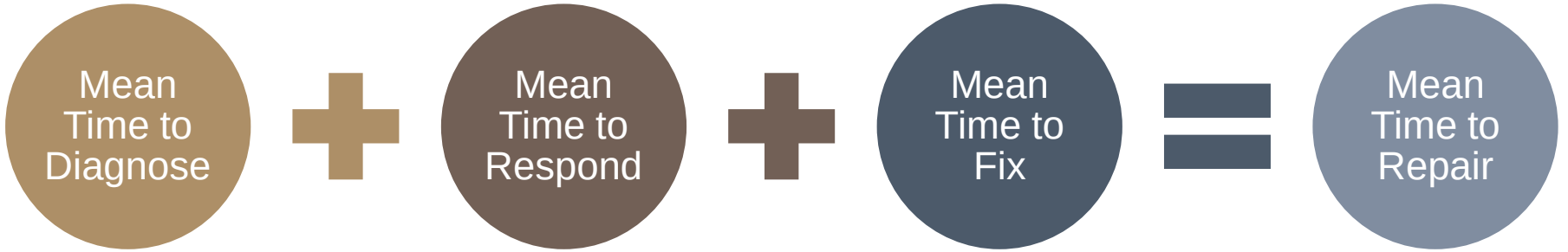
Performance Management

- Failure control and service management
  - Help desk
  - Trouble tickets
  - Problem tracking
  - Problem statistics

Ticket Number	Priority	Issue	Date Submitted	Status	Assigned To
11793	**1 -HIGH**	WAN circuit #1 down	31 Jul	OPEN	Alan
11794	**2 - MEDIUM**	DNS #2 server slow	31 Jul	CLOSED	Alex
11795	3 - LOW	Computer needs more RAM	30 Jul	OPEN	Alex

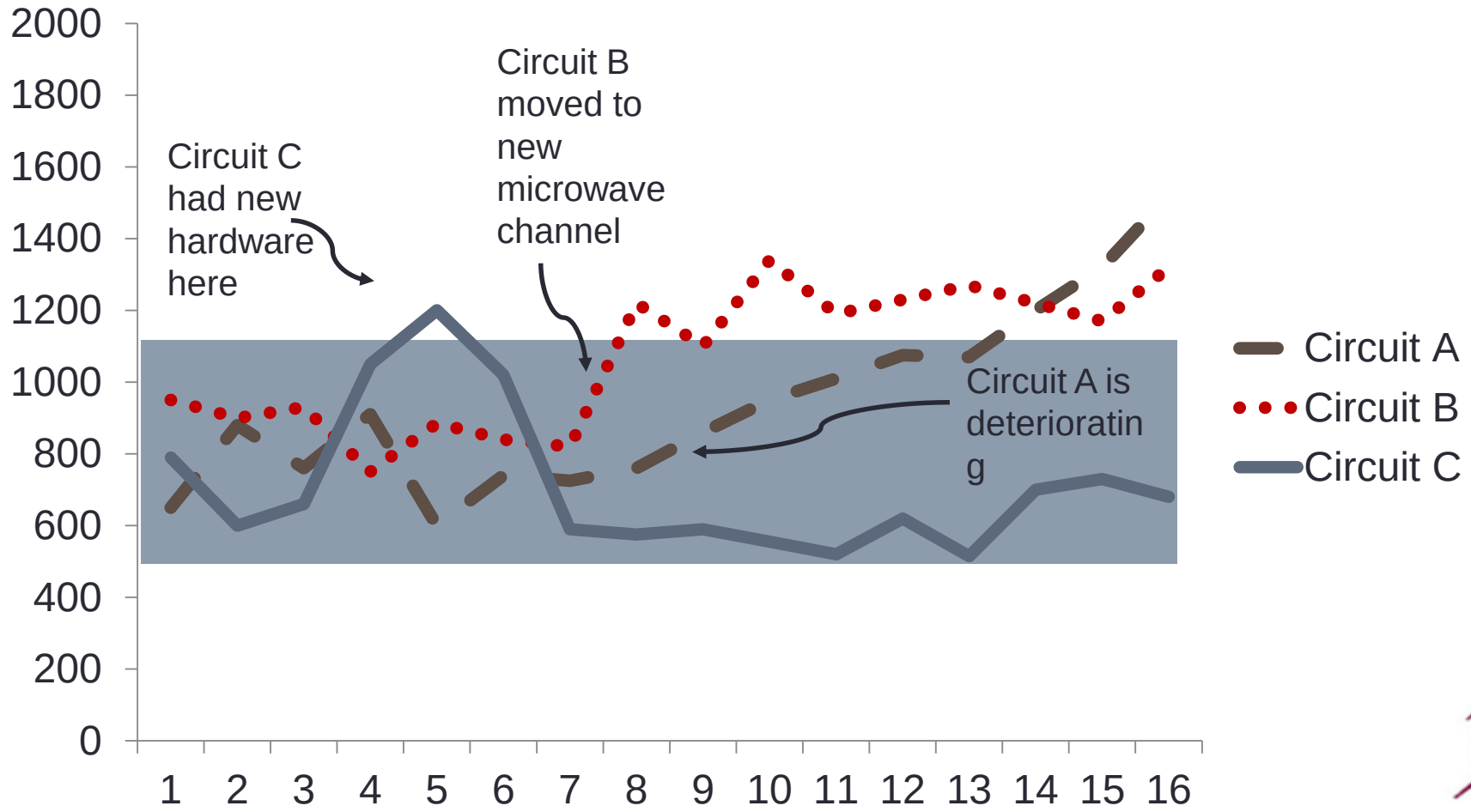
Performance Management

- Statistics
  - Availability (uptime)
  - Downtime
  - Mean time between failures (MTBF)



Performance Management

- Quality control chart



End User Support

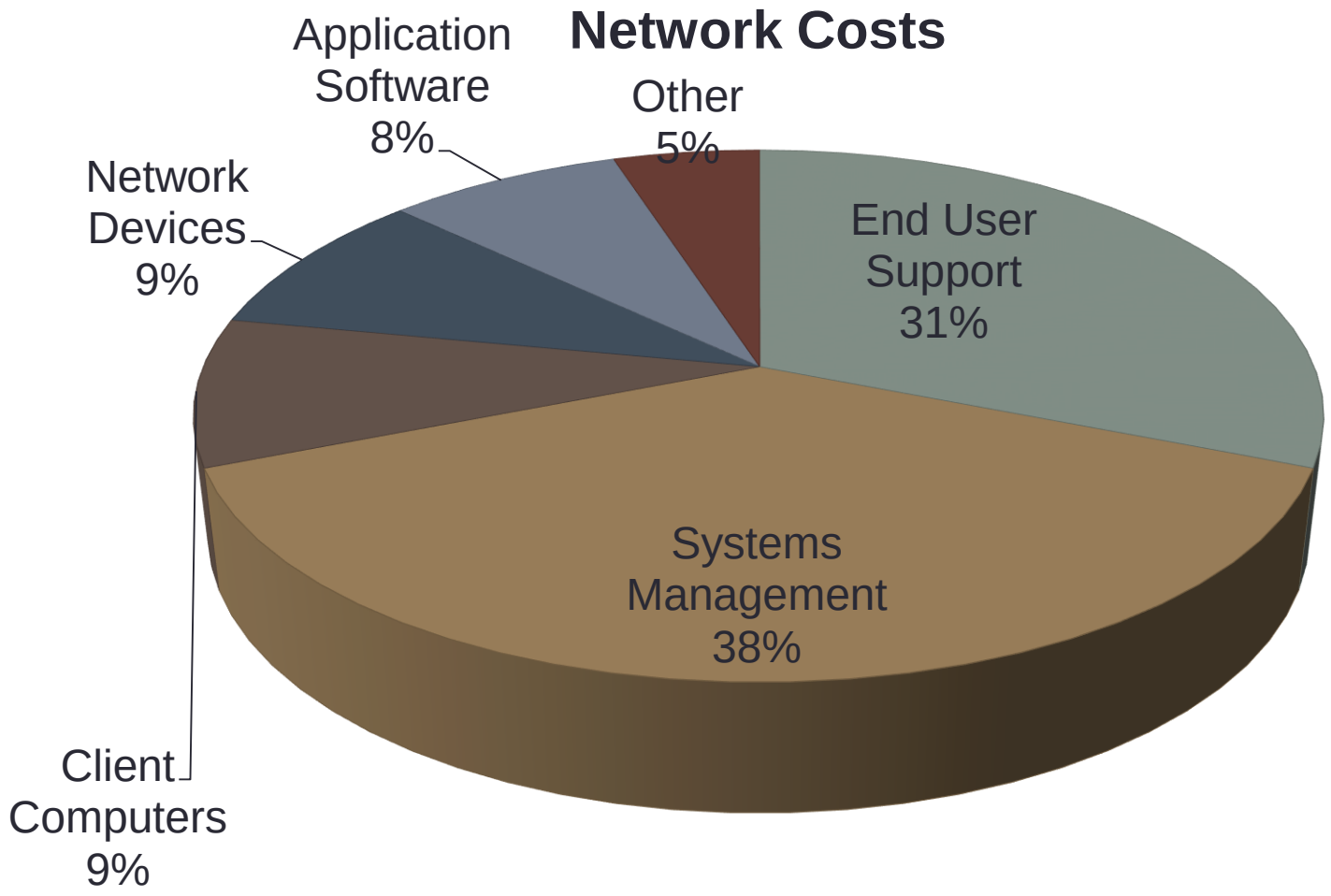
- Solving the problems users encounter while using the network
- Major sources of problems with user equipment
  - Hardware device failures, generally easiest to fix
  - Lack of user knowledge on proper operation, also easier to fix
  - Problems with software, software settings or software incompatibility, generally hardest to fix
- Training is an ongoing responsibility of network manager

Cost Management

- **Total Cost of Ownership (TCO)**
  - A measure of direct and indirect costs to operate a device (e.g., computer) per year
  - Includes cost of
    - Repairs and software/hardware upgrades
    - Support staff (maintain, install, administer, etc.)
    - Training and technical support
    - Time “wasted” by the user when problems occur
  - TCO of a Windows computer
    - Estimated to be $5,000 and $10,000 per computer per year
    - Largest component is lost time
  - Some alternative measures (e.g., NCO) only include direct costs
    - Estimated at $1,500 – $3,500 per computer per year

Cost Management

- Largest costs are personnel, not hardware



Cost Management

- Cost reduction steps
  - Develop standard hardware/software configurations for client computers, servers, and network devices
  - Automate as much of the network management process as possible
  - Reduce the cost of installing new hardware/software by working with vendors
  - Centralize help desks
  - Move to thin client or cloud-based architectures

Implications for Management

- Network management requires technical understanding and management skills
- Managers must explain the business value of the networks to justify its increasing cost
- Network management is increasing its complexity
- Qualified personnel costs much more than hardware