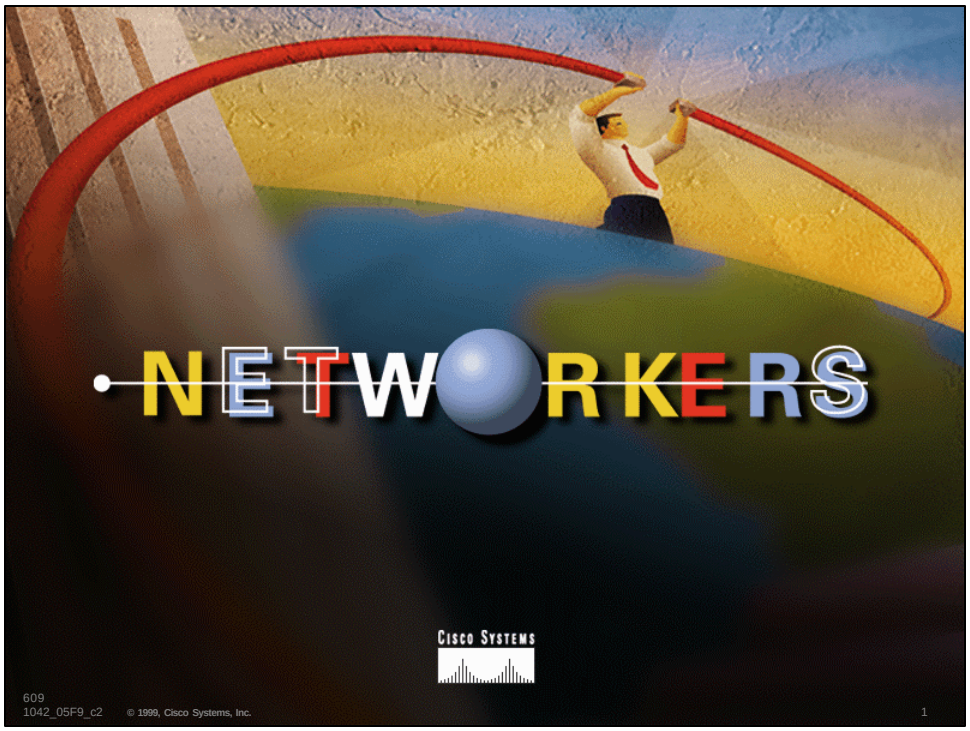
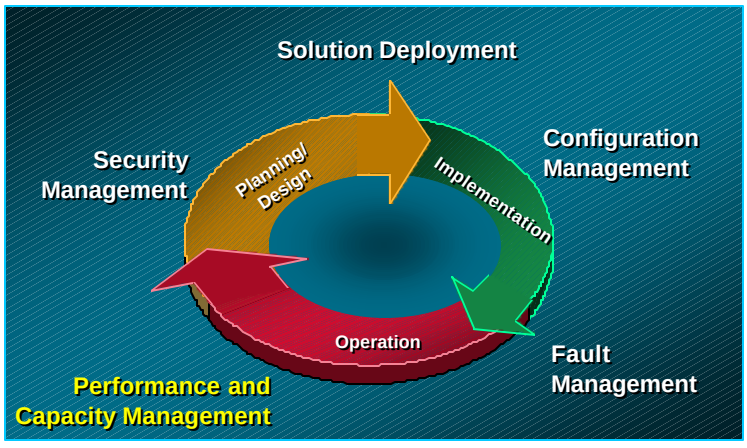


Agenda

- Introductions/Goals
- Capacity Planning Model
- Capacity Data Collection Tools and Reporting
- Best Practices for Capacity Planning
- Q&A

Network Life-Cycle Model



Performance Management and Capacity Planning Definitions

- **Capacity planning**

  The process of determining the likely future network resource requirements to prevent a performance impact on business critical applications

- **Performance management**

  The practice of managing network service response time, consistency and quality for individual services and services overall

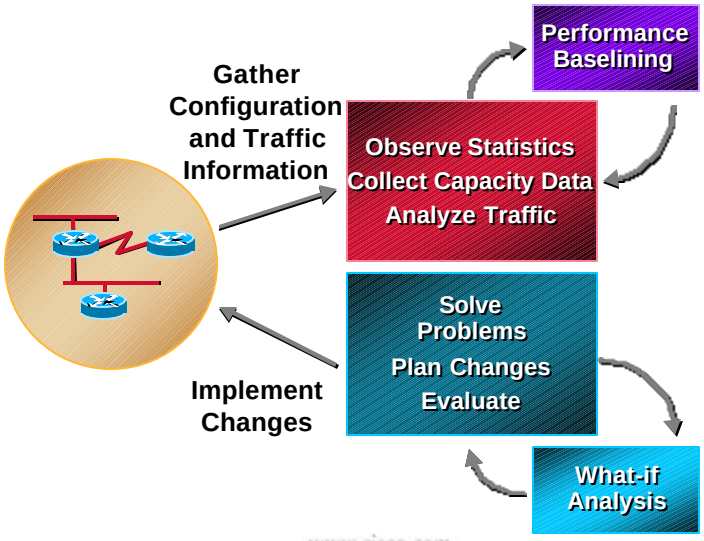
Increasing Importance of Capacity Planning

- **Frequent application deployment failure**
- **Increased reliance on network services for business applications**
- **Exponential growth in business and nonbusiness related traffic**
- **Network Failure is typically capacity related**

Capacity Related Risks

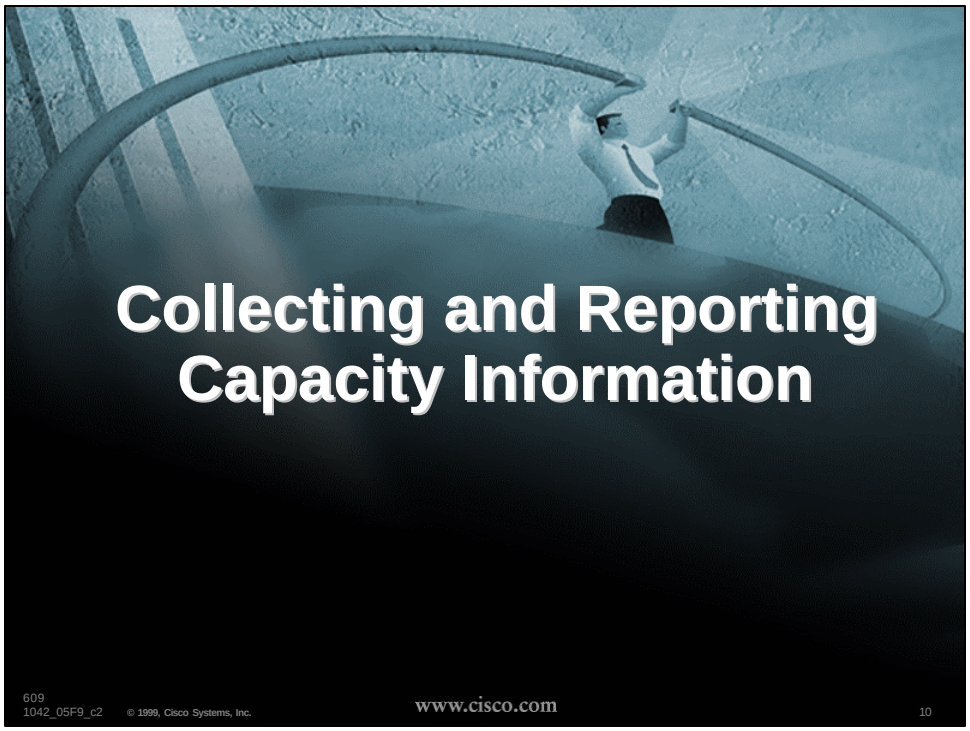
- Network degradation and failure
- Application timeouts and failure
- Application performance degradation

Effective Capacity Management



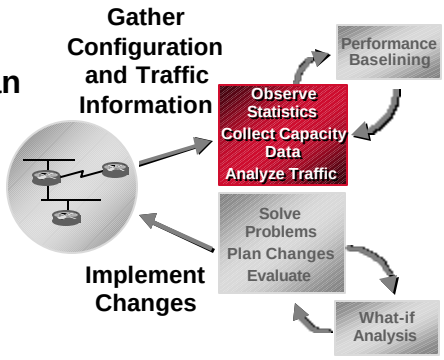
Resource Constraints or Bottlenecks

- CPU
- Memory
- Buffering, queuing and latency
- Interface and pipe sizes
- Speed and distance
- Application characteristics



Collecting and Reporting Capacity Information

- Development of information collection plan
- Tools for collecting capacity information
- Defining capacity areas
- Reporting and interpreting results



Information to Collect

- Link utilization
- CPU
- Memory
- Performance (ping response time)
- Queue/buffer drops
- Broadcast volume
- Frame Relay DE, FECN, BECN, traffic-shaping parameters
- NetFlow statistics
- RMON

Link Utilization

Resource	Address	Segment	Avg. Util (%)	Peak Util (%)
JTKR01S2	10.2.6.1	128 Kbps	66.3	97.6
JYKR01S0	10.2.6.2	128 Kbps	66.3	97.8
FMCR18S4/4	10.2.5.1	384 Kbps	51.3	109.7
PACR01S3/1	10.2.5.2	384 Kbps	51.1	98.4

CPU Utilization

Resource	Polling Address	Avg. Util (%)	Peak Util (%)
FSTR01	10.28.142.1	60.4	80
NERT06	10.170.2.1	47	86
NORR01	10.73.200.1	47	99
RTCR01	10.49.136.1	42	98

Performance (Ping Response Time)

Resource	Address	AvRes T (mS) 09-09-98	AvRes T (mS) 09-09-98	AvRes T (mS) 09-24-98	AvRes T (mS) 10-01-98
AADR01	10.190.56.1	469.1	852.4	461.1	873.2
ABNR01	10.190.52.1	486.1	869.2	489.5	880.2
APRR01	10.190.54.1	490.7	883.4	485.2	892.5
ASAR01	10.196.170.1	619.6	912.3	613.5	902.2
ASRR01	10.196.178.1	667.7	976.4	655.5	948.6
ASYR01S					503.4
AZWRT01	10.177.32.1	460.1		444.7	
BEJR01	10.195.18.1	1023.7	1064.6	1184	1021.9

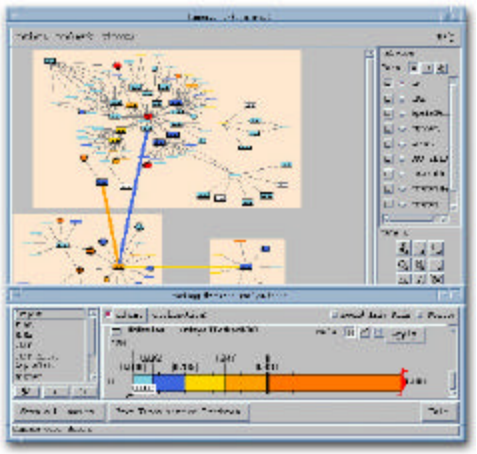
RMON Collection

- **RMON traps/collectors**
- **RMON router commands**

```
rmon event 1 trap MSTrap description "CPU Util>75%"
rmon event 2 trap MSTrap description "CPU Util<75%"
rmon event 3 trap MSTrap description "CPU Util>90%"
rmon event 4 trap MSTrap description "CPU Util<90%"
rmon alarm 75 lsystem.56.0 10 absolute rising-threshold 75 1
falling-threshold 75 2
rmon alarm 90 lsystem.56.0 10 absolute rising-threshold 90 3
falling-threshold 90 4
```

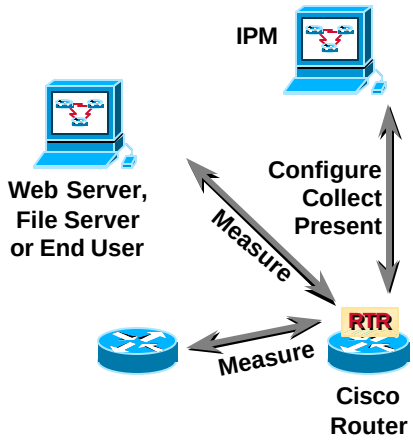
Netsys Service Level Management

- Performance baseline
- End-to-end traffic baseline with RMON collectors, SNMP and NetFLow statistics
- Define service level performance policies
- Assess service level policy performance

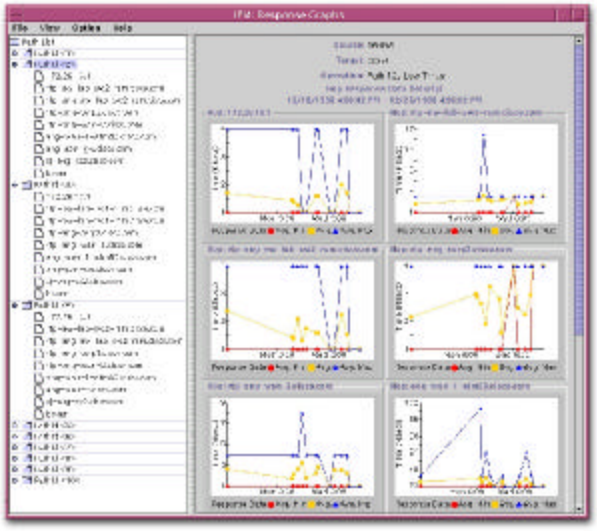


Internet Performance Monitor

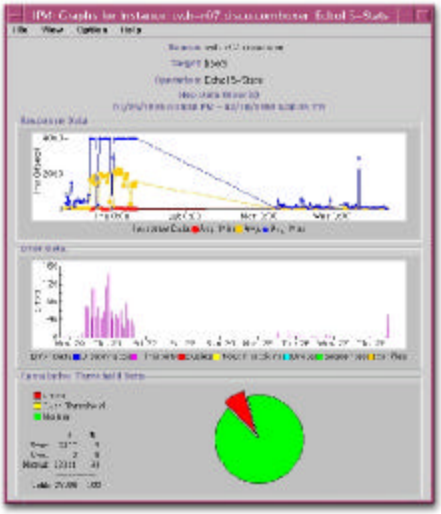
- **WAN troubleshooting**
  - Complements CiscoWorks 2000
  - Measures hop-by-hop response time and availability
  - Evaluates thresholds and generates alarms
  - Provides real-time, and historical reports
- **Utilizes RTR agent embedded in Cisco IOS®**
  - No extra management hardware required
  - Leverages large installed base of Cisco routers



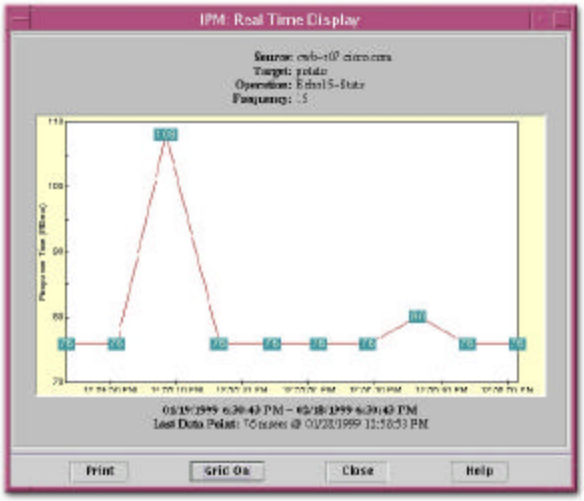
IPM Hop-by-Hop Reports



IPM—Historical Reports



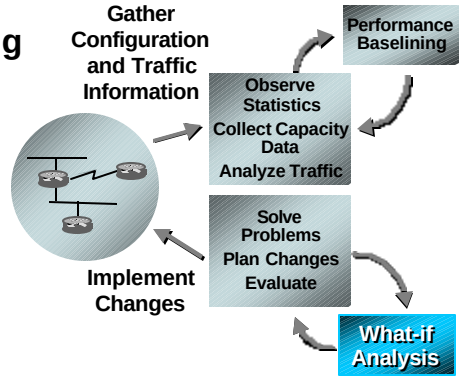
IPM—Real-Time Reports



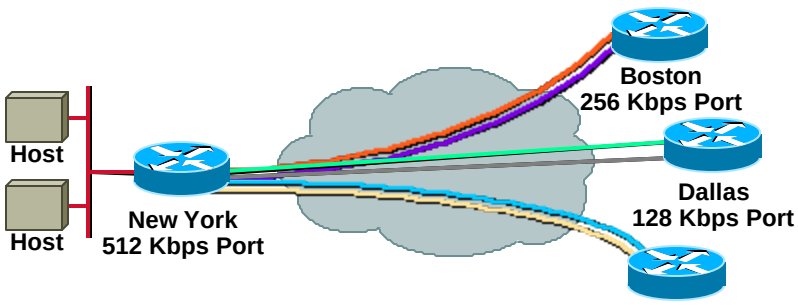
Capacity and Performance Best Practices

What-If Analysis

- Simulation applications
- Lab application modeling
  - Protocol analyzer, WAN emulator, packet generator, NETSYS performance analyzer
- Lab network modeling
  - NVS/NVT, lab network modeling



Frame Relay Subscription Parameters



- New York to Boston PVC 128 Kbps CIR
- Boston to New York PVC 32 Kbps CIR
- New York to Dallas 64 Kbps CIR
- Dallas to New York 32 Kbps CIR
- New York to Atlanta 96 Kbps CIR
- Atlanta to New York 32 Kbps CIR

Service Level Management

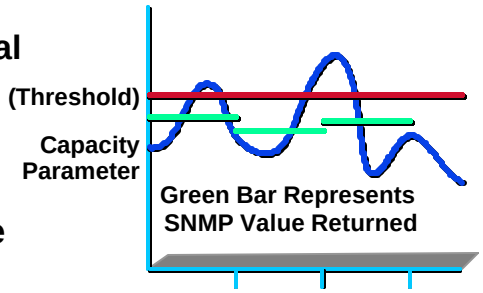
- Define performance requirements
- Define Upgrade criteria by capacity area
- Measure capacity and performance
- Review thresholds and baseline
- Take action!

Service Level Management

Threshold	WAN	LAN
CPU	75-90%	75-90%
Link	80-90%	40-90%
Memory	50%	50%
Output Queue	200	25
Buffer Misses	Any	Any
Broadcast Vol	10/Sec	300/Sec
FECN/BECN	10/Sec	N/A

Peak and Average Utilization

- Solution to narrow collection interval
- Low collection interval = high overhead
- Recommend >=5 minutes
- Peak values not quite what they seem
- Close to threshold indicates likely exceed condition

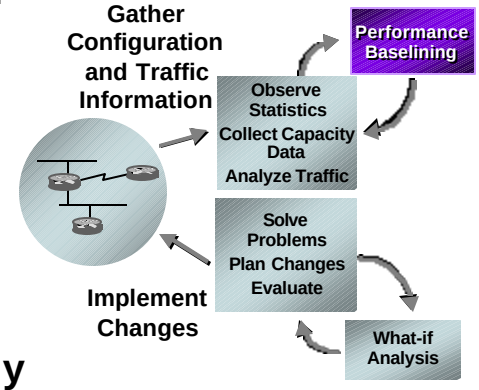


Capacity Exception Management

- Alarm critical capacity thresholds (CPU, critical link)
- Develop notification, escalation and action plan for threshold violations
- Take action!

Performance and Capacity Baselining

- Interface utilization
- Device CPU, memory, buffer, I/O utilization
- Network overhead
- Raw performance characteristics
- Monthly or quarterly baseline report



Upgrade Planning

- Understand lead times for circuits, equipment, planning and design
- upgrade criteria based on service level management

QoS Management

- Prioritize applications by business impact
- Understand networked application behavior (packet size, timeouts, flows, bandwidth requirements)
- Develop QoS management plan

WAN Subscription Parameters