Performance Management 101
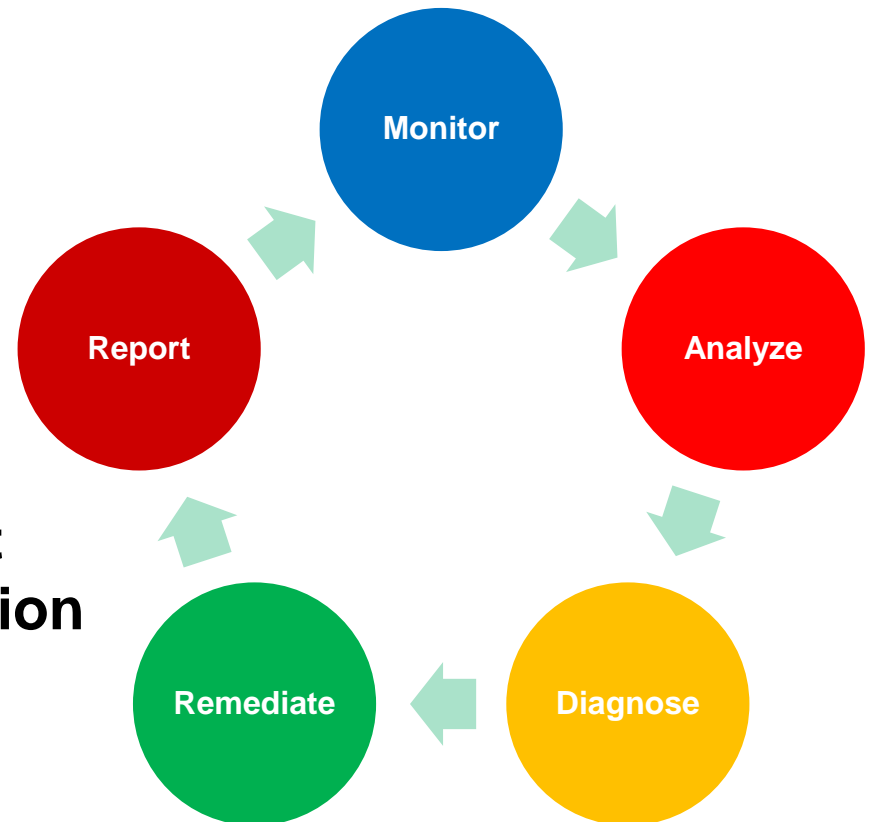# Share Session Anaheim

Laura Knapp
WW Business Consultant
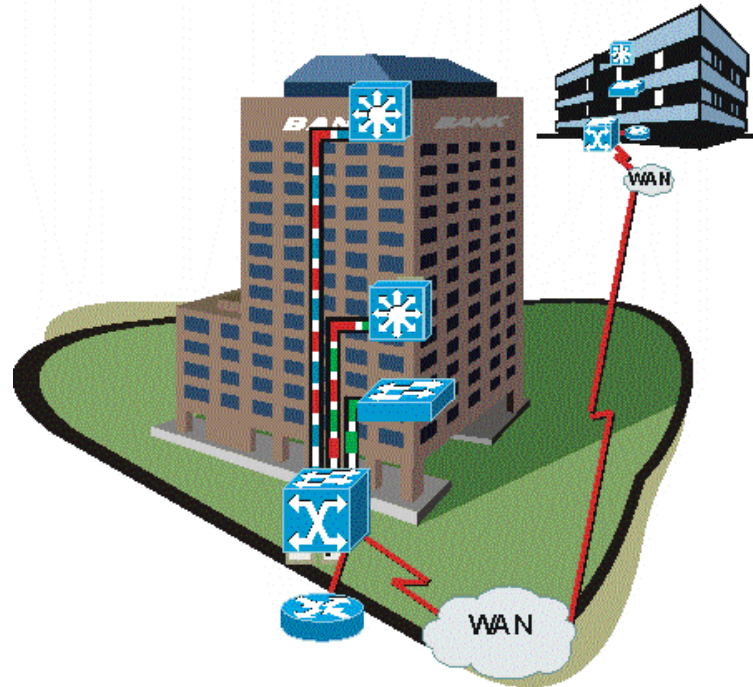**Laurak@aesclever.com**

Managing Fundamentals

- **FCAPS**
  - **Fault**
  - **Configuration**
  - **Availability**
  - **Performance**
  - **Security**

- **Leading to**
  - **Service Level Achievement**
  - **Optimum Resource Utilization**
  - **Highly available systems**
  - **High performing systems**

© Applied Expert Systems, Inc. 2010

FACPS

Fault Management
What is the Status?

Configuration Management
What is the configuration?

Availability Management
What's down?   What's available?
What's up?

Performance Management
How consistent?   How many?
How much?   How fast?

Security Management
Who can access?   Identify yourself?
Can everyone see it?

© Applied Expert Systems, Inc. 2011

Agenda

Introduction and goals

Performance planning model

Practices for performance planning

Best Practices

© Applied Expert Systems, Inc. 2011
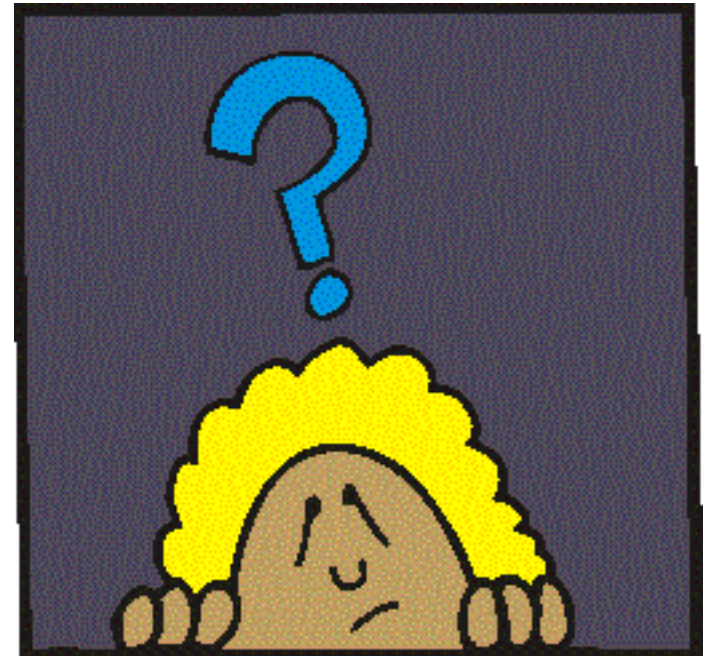
Recognize This?

© Applied Expert Systems, Inc. 2011
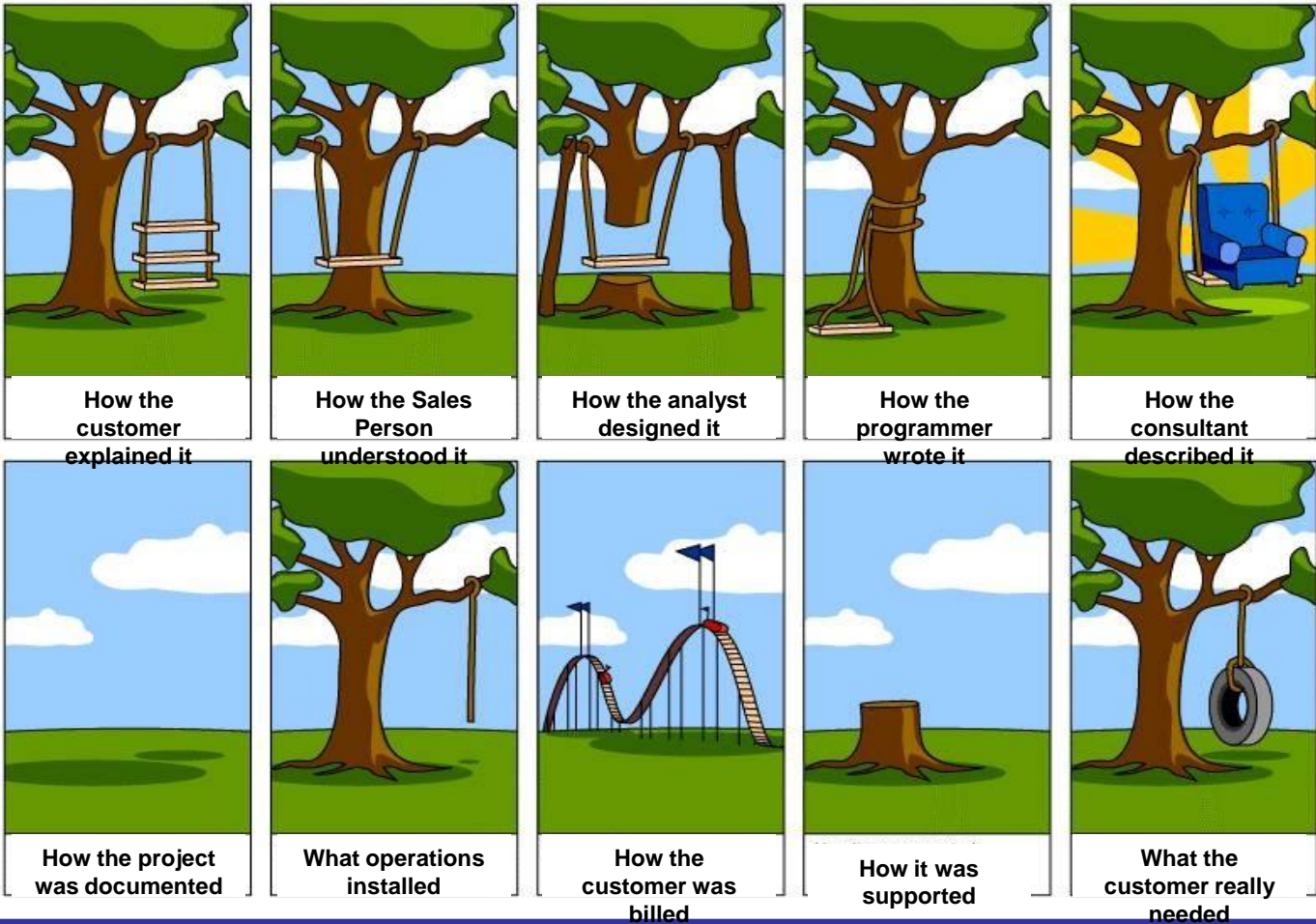
Murphy's Law

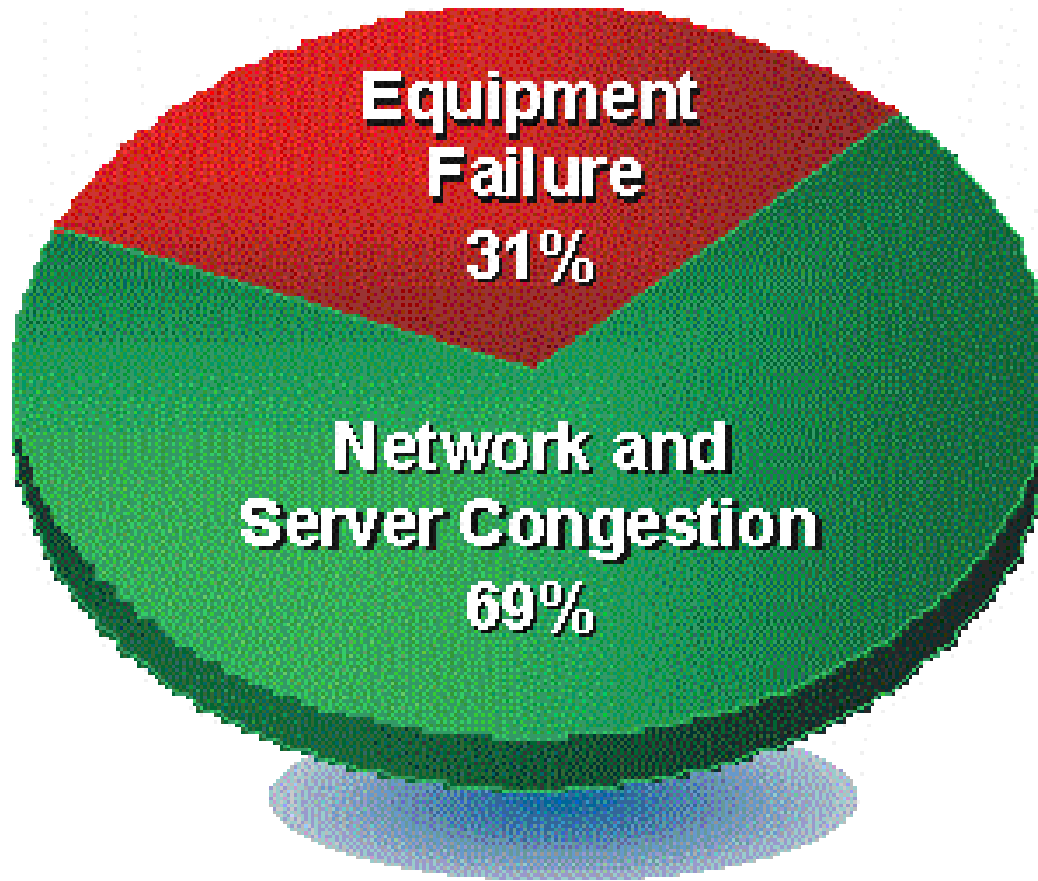If anything can go wrong, it will

If anything just cannot go wrong it will

Left to themselves, things tend tend to go from bad to worse

If everything seems to be going well, you have obviously overlooked something

Congestion and Performance degradation

© Applied Expert Systems, Inc. 2011

Performance Management

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

Performance Related Risks

  Network degradation and failure
  Application timeouts and failure
  Application degradation

Performance Identifiers

  Normal baseline of performance
  Current or potential utilization problems
  Slow response time
  Application, server, network availability
  Optimum data transfer times
  Violation of SLAs, QoS policies, or CoS guarantees

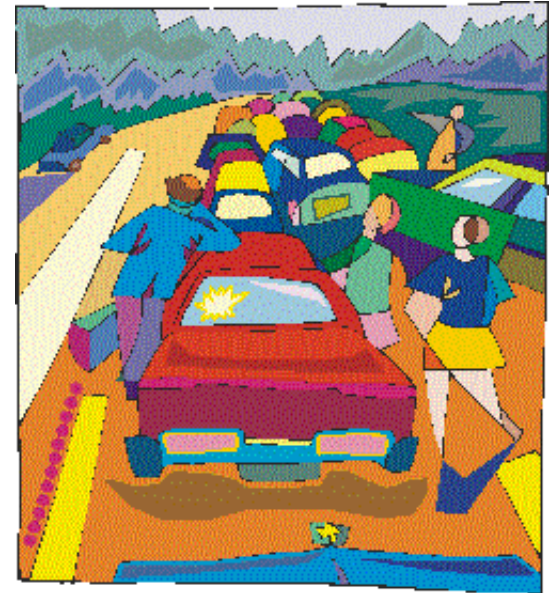© Applied Expert Systems, Inc. 2011

The Performance Problem

Over – Provisioning

Lots of provisions (rare)

More resources than can be consumed
Food on cruise line
Congressional parking spaces
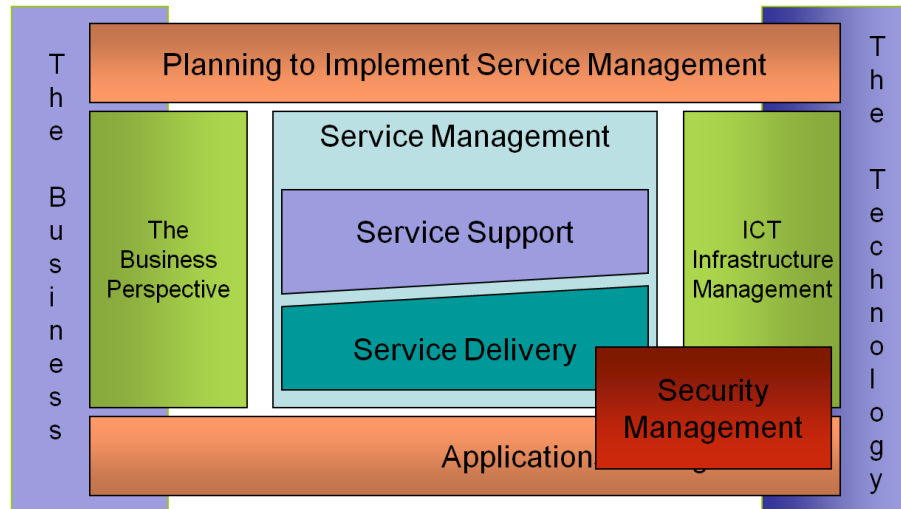

Over – Subscribing

Lots of subscribers (common)

Many users consume all the resources
Phone calls on Mother's day
Milk and bread if an ice storm hits the south

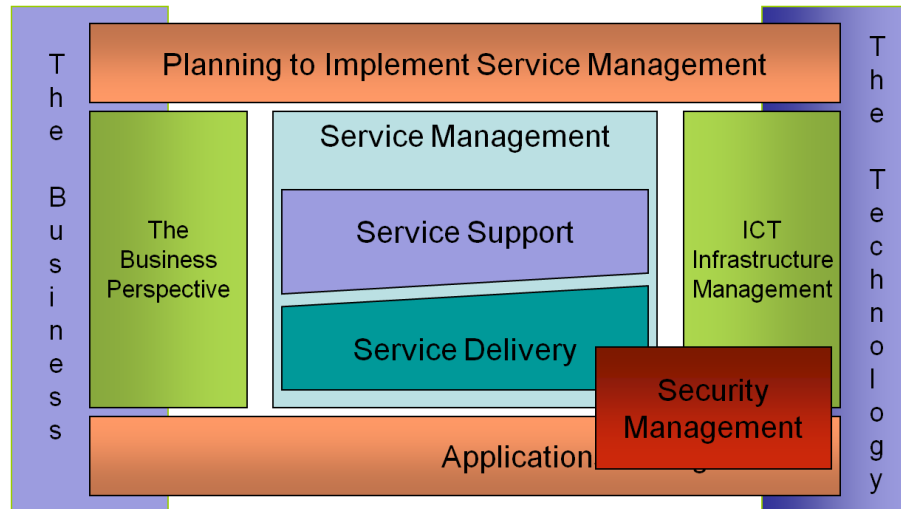# Performance Interaction with Fault Management

Proactive fault management is the area that ties together fault, performance and change management into an ideal network management system

Processing performance data may uncover network faults

Excessive or repeated faults may lead to change of monitored resources

Real-time notifications of performance related items

© Applied Expert Systems, Inc. 2011

# Performance Interaction with Configuration Management

Analysis of performance data may lead to configuration changes

Define and validate protocol usage by systems, servers, applications

Ensure management protocols are appropriately defined

Ensure correct interaction with management subsystems like DNS, NTP, etc.

© Applied Expert Systems, Inc. 2011

Performance Interaction with Security Management
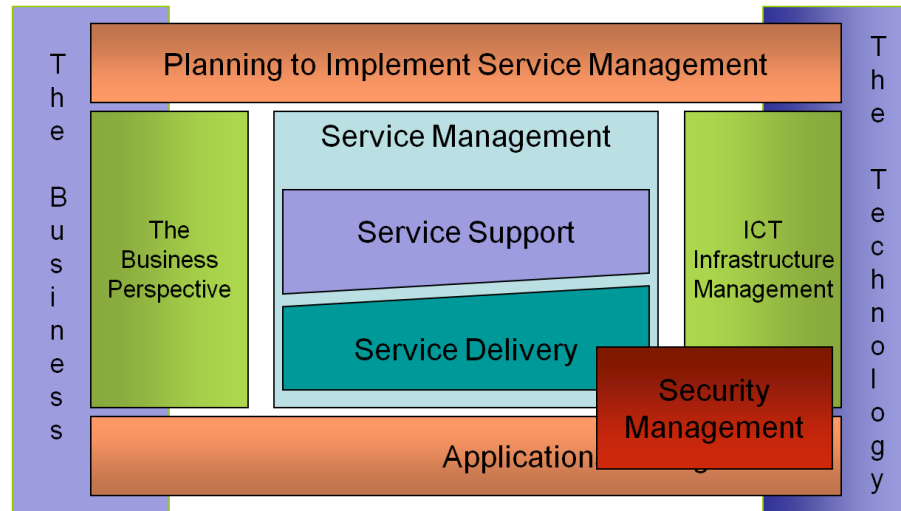
Read only access to devices

Use of SNMP views to restrict unauthorized use of SNMP information

Don't make performance data collection a Denial of Service attack against the network or systems

Security logs may be used during performance analysis
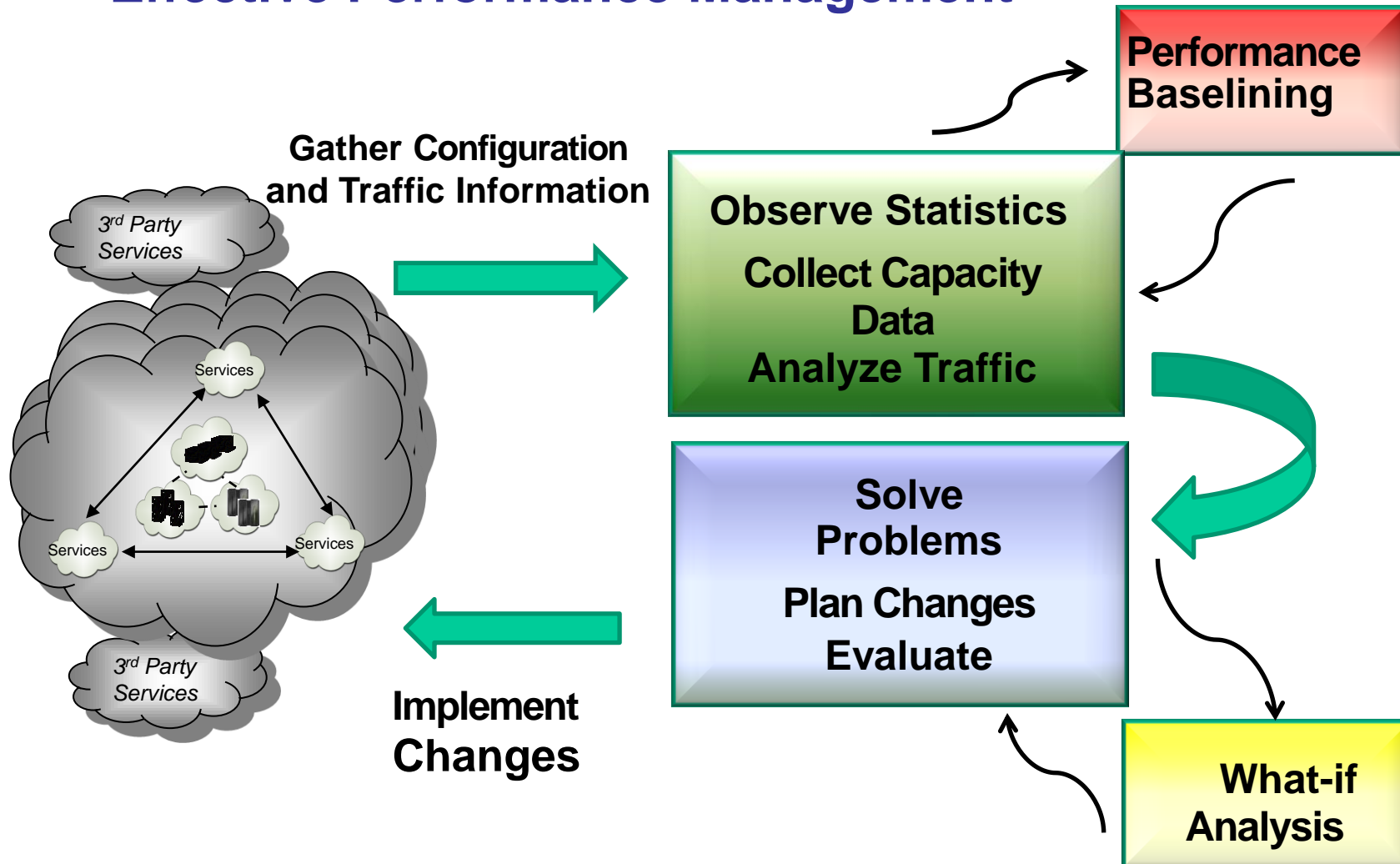
Agenda

Introduction and goals

Performance planning model

Practices for performance planning

Best Practices

© Applied Expert Systems, Inc. 2011

Effective Performance Management

Performance Baselining

Gather Configuration and Traffic Information

3rd Party Services

Services

Services

Services

3rd Party Services

Observe Statistics

Collect Capacity Data

Analyze Traffic

Solve Problems

Plan Changes

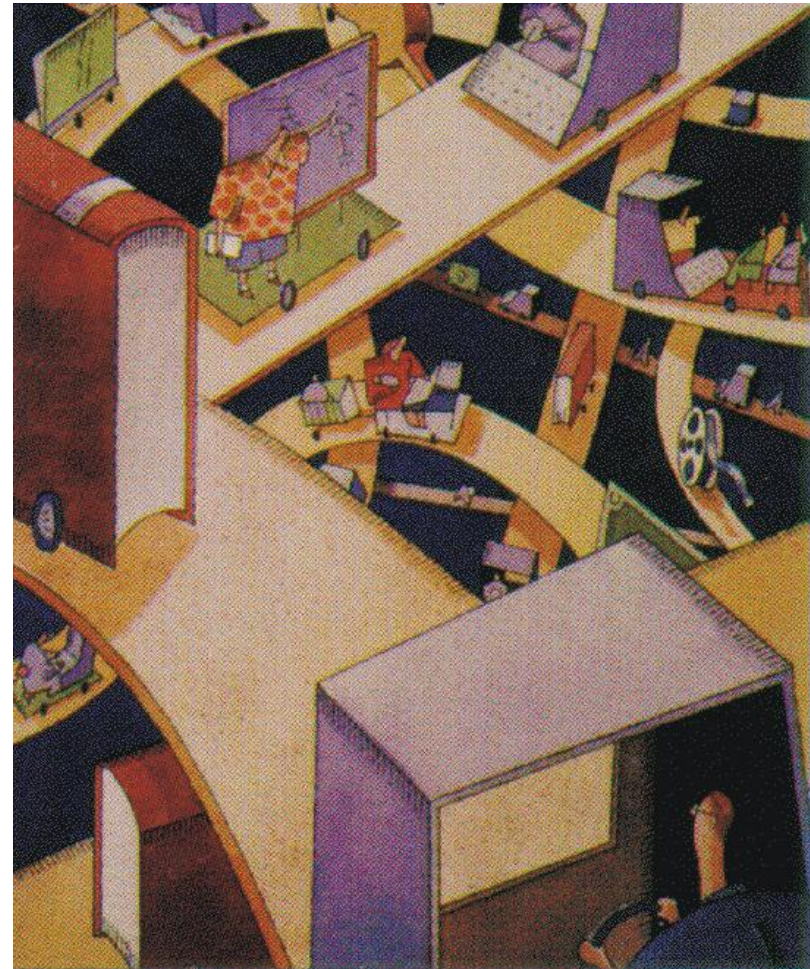**Evaluate**

Implement Changes

What-if Analysis

IP Resource Bottlenecks

CPU
Memory
Buffering, queuing, and latency
Interface and pipe sizes
Network capacity
Speed and Distance
Application Characteristics

Results in:

Network capacity problems
Utilization overload
Application slowdown or failure

Information to Collect

Link/segment utilization

CPU Utilization

Memory utilization

Response Time

Round Trip Time

Queue/buffer drops

Broadcast volumes

Traffic shaping parameters

RMON statistics

Packet/frame drop/loss

Environment specific
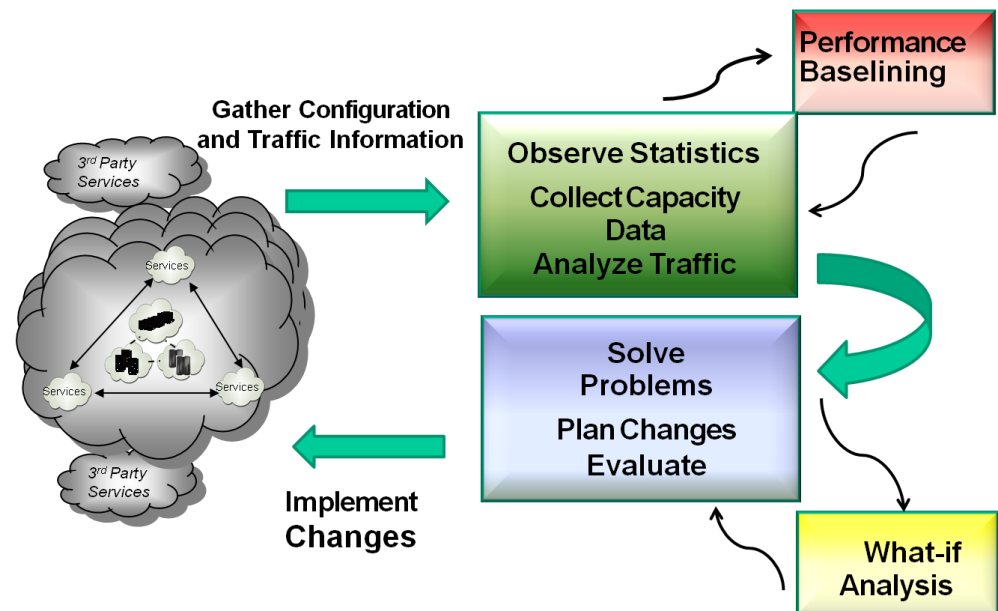
Performance Plan

Develop information collection plan
> Define parameters to be monitored/measured and the thresholds
> Acquire proper authority to collect and monitor/measure
> Acquire proper authority to change thresholds
> Determine frequency of monitoring and reporting
> Define parameters that trigger alert mechanism

Define performance areas of interest

Report and interpret results

Determine tools for collecting information

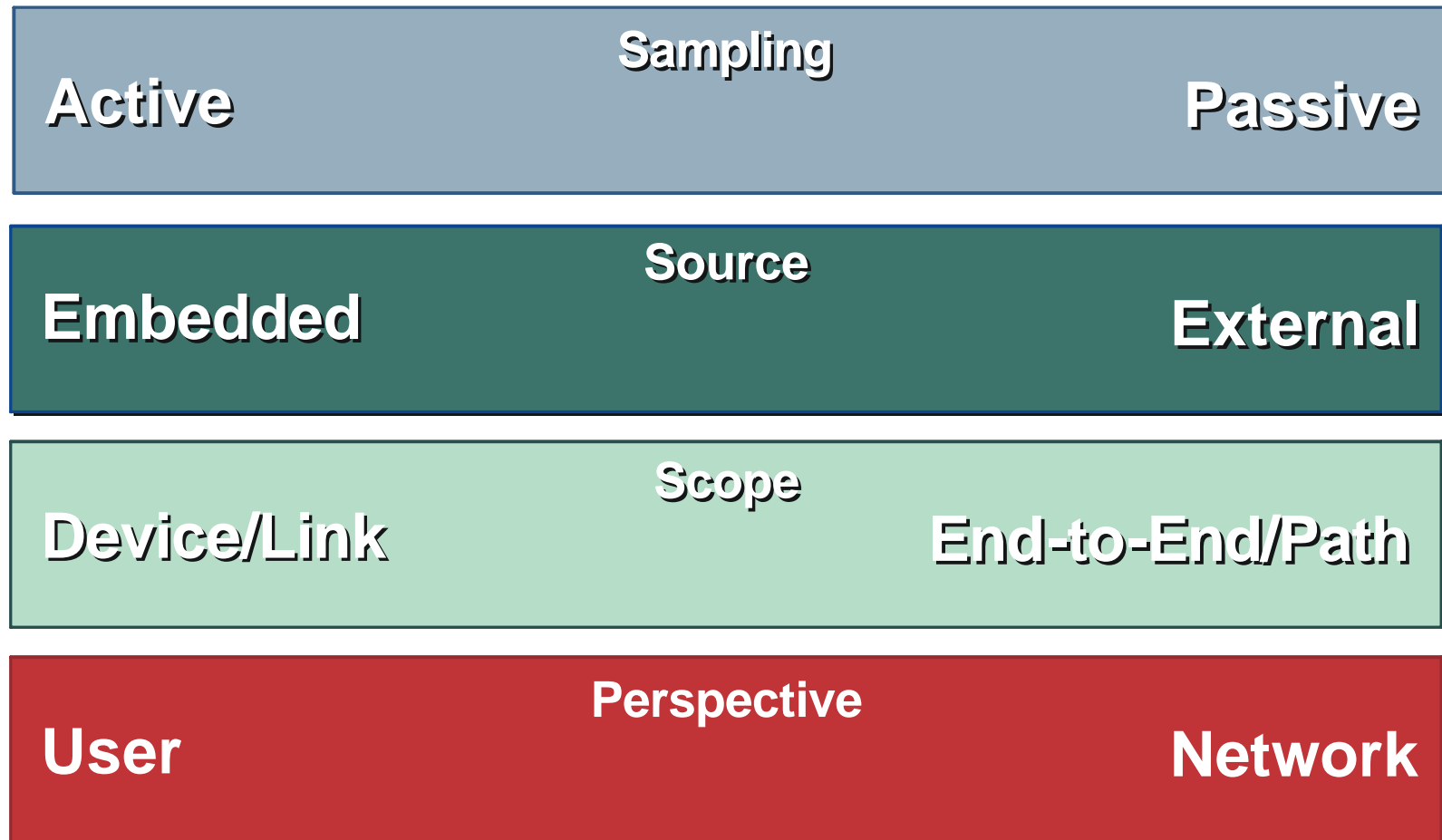Determine tools for analyzing information

© Applied Expert Systems, Inc. 2011

Agenda

Introduction and goals

Performance planning model

Practices for performance planning

Best Practices

© Applied Expert Systems, Inc. 2011

Performance Management Practices

Sampling	
Active	**Passive**

Source	
Embedded	**External**

Scope	
Device/Link	**End-to-End/Path**

Perspective	
User	**Network**

Active and Passive Performance Management

Passive	Active
• **Definition** Actual end-user network traffic where performance is measured by timing specific application traffic flows • **Advantages** Most accurate for live application traffic on a specified link • **Disadvantages** Limited to measuring: Existing traffic types, which may not be present on the network at all times Existing traffic patterns, which may not reflect patterns for new or future applications	• **Definition** Network traffic generated strictly for the purpose of measuring a network performance characteristic • **Advantages** Measures performance: Between any two points in the network Controllable, on a continuous basis By traffic class based on IP Precedence marking • **Disadvantages** Only an approximation for performance of live traffic

20

Embedded or External Sourcing

Embedded	External
• **Definition**	• **Definition**
Mechanisms for collection of network statistics are integrated into the network communication device (e.g., router or switch), itself	**Mechanisms for collection of network statistics are provided by a stand-alone device specifically designed to collect network performance statistics**
• **Advantages**	• **Advantages**
Follows network infrastructure	**Validation of performance performed independent of the devices that transmit network traffic**
Gathers metrics that cannot be observed externally	
• **Disadvantages**	• **Disadvantages**
Performance monitoring has device-level performance implications	**More hardware to administer**
	Observed statistics limited to points of deployment

Scoping Practices

Device or Link Oriented

- **Definition**

  Performance measurement based on analysis of specific device or device interface, and typically based on utilization rates

- **Advantages**

  Detailed application performance monitoring of critical network links

- **Disadvantages**

  When network-wide performance problems exist, how does one select which device or link to evaluate?

End-to-End

- **Definition**

  Performance measurement based on analysis of response time across two or more network devices, and typically based on latency

- **Advantages**

  Starting point performance troubleshooting

  Reflects end-user experience

- **Disadvantages**

  Prior knowledge of relevant end-to-end paths is needed

User or Network Perspective

User	Network
• **Definition**	• **Definition**
Measurement based on performance statistics measured at the end-user workstation	Measurement based on performance statistics measured in network devices
• **Advantages**	• **Advantages**
Accurate measurement of end-user experience	Easy to deploy, and non-intrusive to the desktop
• **Disadvantages**	Identifies network performance issue
Scale and distribution issues	• **Disadvantages**
Intrusive on the desktop	Imperfect understanding of end-user experience

Steps to Effective Performance Management

Baseline

Baselines over a long period of time to develop utilization, resource. growth and shrinking trends

What-if analysis prior to deployment

Setup Alarms and Thresholds

Excessive Missed Faults

Performance exception reporting

Analyze the capacity information

Review baseline, exception, and capacity information on a periodic bases

Monitor

Baseline Your Network

Gather inventory information

Gather statistics at a given time(s)

Monitor statistics over time and
study traffic flows

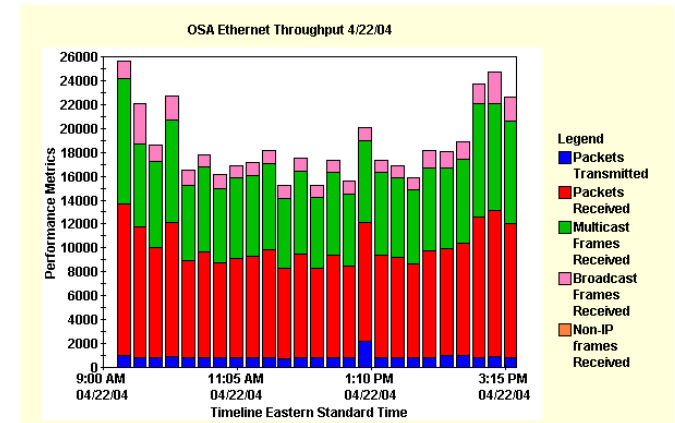Have logical maps of network, server and application views

Know the protocols and traffic profiles

Document physical and logical network

Document detailed and measurable SLAs

Have a list of variable collected for your baseline

Be part of change control system

2/8/2011

Agenda

Introduction and goals

Performance planning model

Practices for performance planning

Best Practices

© Applied Expert Systems, Inc. 2011

Statistics and Performance Management

Statistical analysis is part of Performance Management

Measuring network an service availability

Analyzing performance data
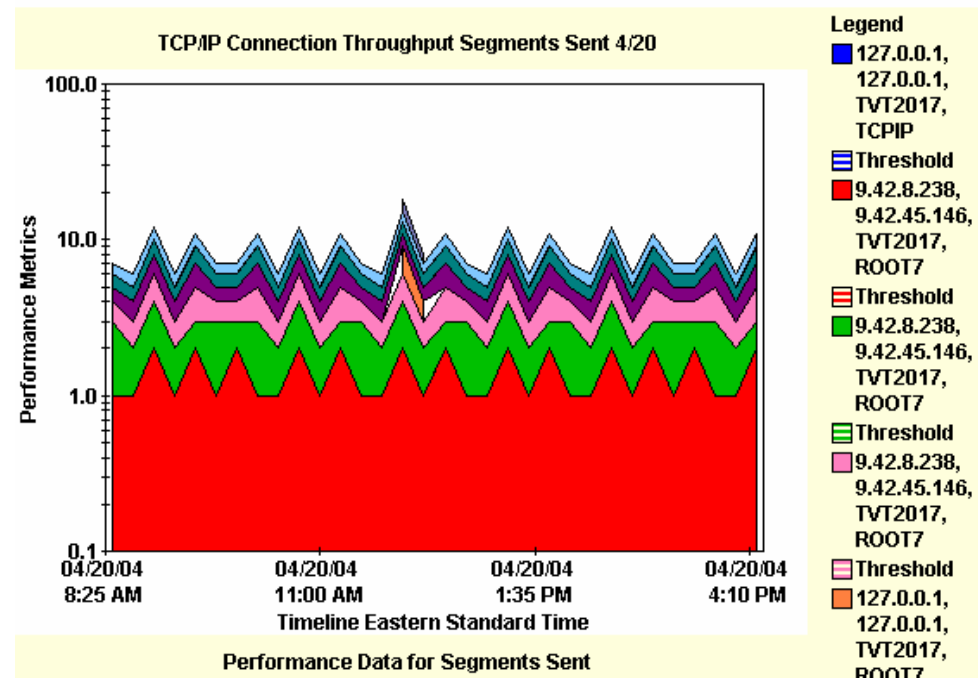
Aggregating raw data

Key statistical methods used

Average

Mode

Media

Standard Deviation

Variance

© Applied Expert Systems, Inc. 2011

Availability Types

Calculated availability

    Mean Time Between Failure (MTBF)
      (Average time between failures)

    Mean Time to Repair(MTTR)
      (Time between when something
      broke and it was restored to
      service)

Monitored availability

    Monitoring

    Trouble ticketing

    Probes

$$\text{Device Availability} = \frac{MTBF}{MTBF + MTTR} \qquad (1)$$

$$\text{Unavailability} = 1 - \text{Availability} \qquad (2)$$

$$A_{Serie} = \prod_{i=1}^{N} A_k \quad = A_1 \cdot A_2 \cdot \ldots \cdot A_N \qquad (3)$$

$$A_{Parallel} = 1 - \prod^{N}(1 - A_k) = 1 - (1 - A_1) \cdot \ldots \cdot (1 - A_N) \qquad (4)$$

Statistical Measures

Analyze and condense data collected

Predict what will be

Basic statistical applications
   Sample size and polling interval
   Measure of tendency (average)
   Measure of spread (standard deviation)
   Probability and cumulative density

HPR RTP Connections Throughput and Traffic View

Ensure good data collected
   Need to collect enough data points for accuracy
   Sample at a high enough rate to provide the detail
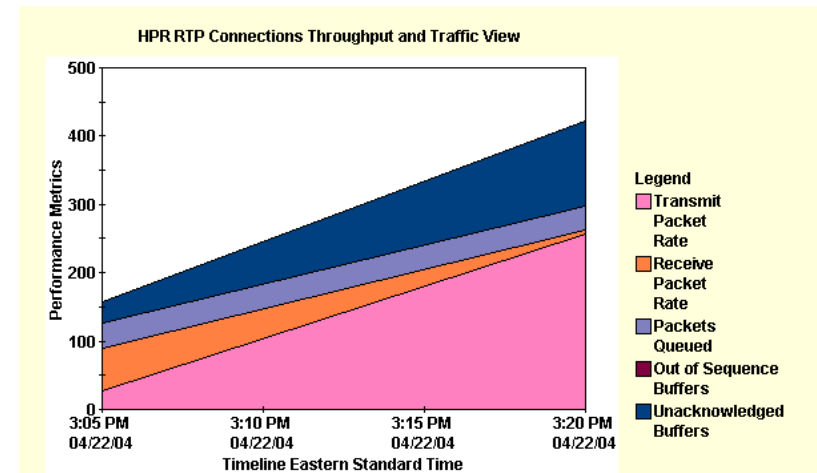   required (but not flood the network)
   Adjust sampling based on analysis or timeliness

Key Statistical Measures
   Measure of central tendency (average, mode, median)
   Measures of spread (standard deviation)
   Probability of density function

Sampling Rate and Size

Sample size is the number of samples that have been collected

Sampling rage is the rate at which the data is collected from the network

$$\text{Sampling} = \frac{1}{\text{Polling Interval}}$$

The higher the sampling rate the more detailed the data collection

A date interval of 15 minutes provides 4 times the detail of polling once an hour

© Applied Expert Systems, Inc. 2011

Average-Mean-Mode

Average is the center of a distribution

Mode is the most common occurrence
of a value in a distribution

Median is the middle value in the distribution

Mode and median help identify skews

Assume you collected the following data

120 119 121 110 120 100 128 2400 2390 2405 120 121 100 119 120

Sort data in ascending order

Mode

100 100 110 110 119 119 120 120 120 120 121 121 128 2390 2400 2405

Average   Median

© Applied Expert Systems, Inc. 2011
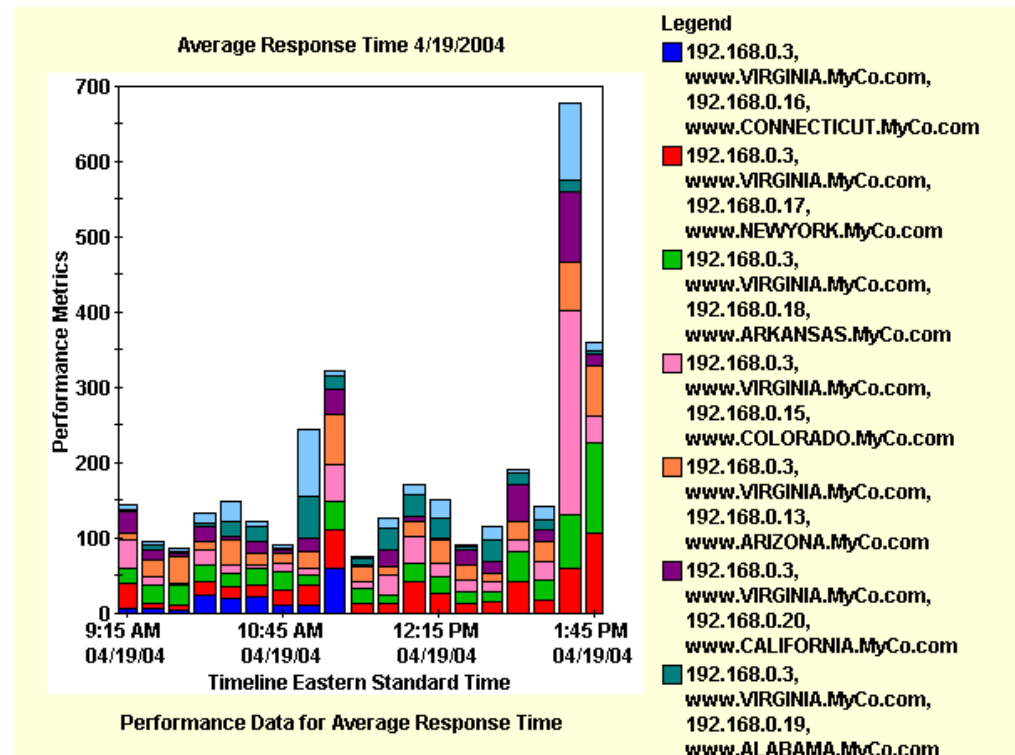
Standard Deviation

Standard deviation is a measure of spread

Looks at all data values

Most well known and
used method

Integrated into most
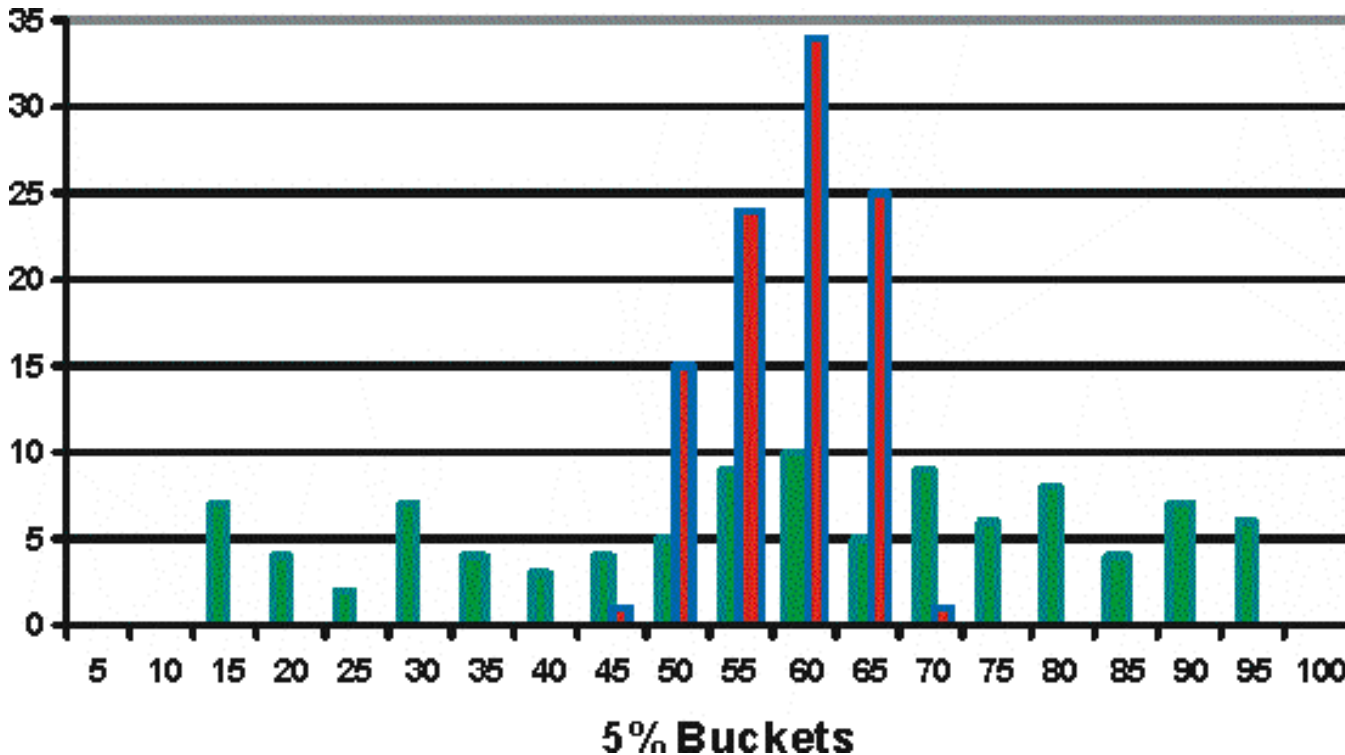management systems

Can be calculated as
data arrives

© Applied Expert Systems, Inc. 2011

Probability Density Function

Groups data into buckets

Provides visualization of data's statistical properties

Measuring Performance

Polling interval and aggregation

RFC 1857
Rule of thumb on polling interval - 15 minutes
24 hour aggregation - 15 minutes
1 month aggregation - 1 hour
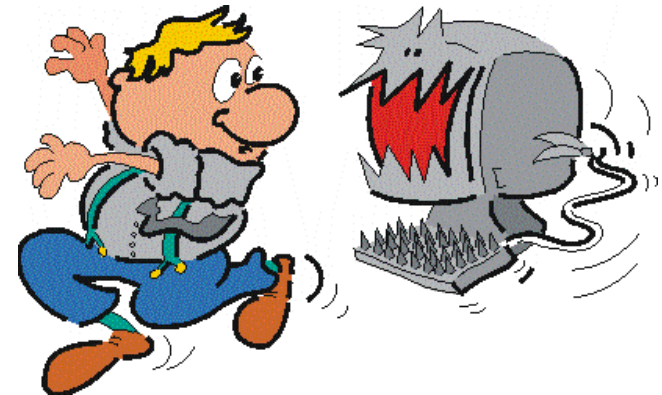1 year aggregation - 1 day

Measuring performance

Availability
Response time
Accuracy
Utilization

Performance Management

You never solve performance problems
....you just keep moving them around
your network

Basic performance issues
remain the same...but QoS and
new information types are
expanding its role

Emerging applications demand high performance

Performance data readily available .... But the
interpretation and action plans are lax

Complexity increases with each new application,
network device, or other change

© Applied Expert Systems, Inc. 2011

Questions?

Vielen Dank

Obrigado!

Ευχαριστώ

Gracias

धन्यवाद

תודה

ขอบคุณ

THANK YOU

شكراً

Teşekkürler

Köszönettel

Bedankt

Merci

Díky

Hvala

laurak@aesclever.com
www.aesclever.com
650-617-2400

Our other presentations:

Tuesday, 9:30 am – 10:30 am: Performance Management 101
Tuesday, 11:00 am - 12:4:00 pm: Performance Management in a Virtualized Environment
Wednesday 3:00 pm – 4:00 pm: Management Changes in IPv6 – Focus on ICMPv6
Thursday 9:30 am – 10:30 am: Hot Topics in Networking and Security
Thursday 1:30 pm – 2:30 pm: Solving OSA Problems
Thursday 3:00 pm – 4:00 pm: Wireless Security Challenges
Friday 8:00 am – 9:00 pm: Keeping Your Network at Peak Performance as you Virtualize the Data Center
Friday 9:30 am – 10:30 am: Virtualization: New Technologies and Methods to Assure the Health of the Infrastructure

2/8/2011