Active vs. Passive Measurement: *Peace Not War*

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Problem Context

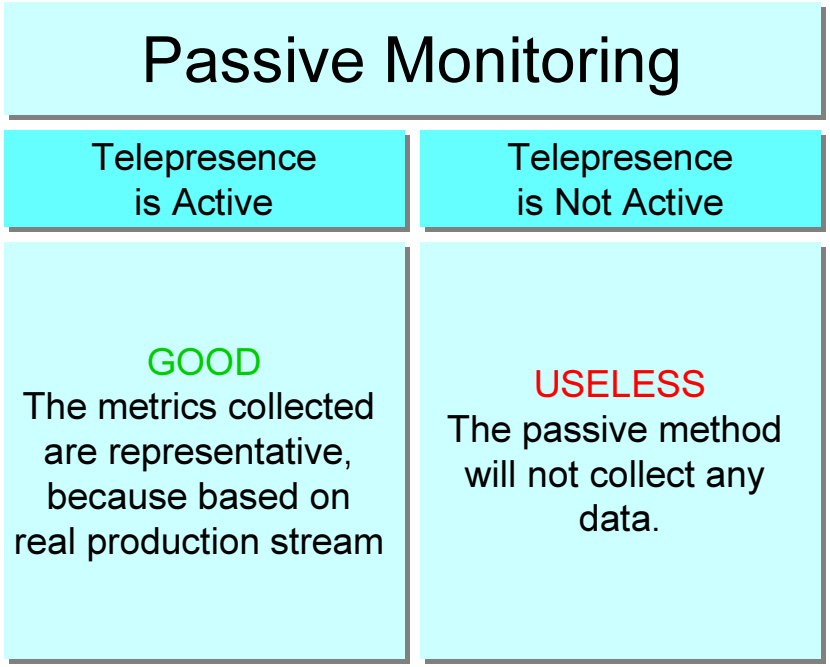
- High bandwidth video like Telepresence requires about 15 Mbps per session
- Best quality of experience requires SLA monitoring, particularly when bandwidth is limited.
- What kind of measurement is the best?

Active Probing -- Synthetic Test Stream

Low BW test (64 Kb/s)	
Telepresence is Active	Telepresence is Not Active
GOOD The metrics collected are representative	NOT RELEVANT The metrics collected do not take into account the additional bandwidth generated by video session.

High BW test (15 Mb/s)	
Telepresence is Active	Telepresence is Not Active
NOT GOOD Creates additional load on the network, may disrupt existing video sessions, may congest the network, ultimately does not collect relevant information.	GOOD Collects a relevant set of metrics, very similar to the real video stream.

Passive Monitoring



Today's Research

- While both approaches are complimentary, **research is primarily focused on either passive or active measurement.**
- In practice, a single approach will not be able to satisfy today's new requirements:

  High Bandwidth video

  Trading floor transactions (with microsecond accuracy)

  Multicast video delivery

- Flexibility: passive and active measurement points offers a wider range of deployment options

What is missing?

- A test methodology / protocol / software that will leverage both solutions, on demand.
- The best option would be used automatically, at the right place, at the right time.
- Active and Passive methods providing the same metrics, so that they can be used independently. (see next slide)

Passive Monitoring and Metrics

- Active measurement provides performance metrics that are harder to get passively, for instance:
  - One way packet delay
  - One way packet jitter
  - One way packet loss
- Today, passive methods are primarily used to detect and track flow of traffic (DoS detection, traffic matrix, etc...)
- A packet signature-based approach would allow passive collection of performance metrics (already exists on the market).

Limitations of today's solutions...

- Mixes both metrics to get an correlated overview, but cannot use one OR the other to achieve a common objective.
- Make assumptions that are impossible in practice (ie: Full-mesh overlay assumption)
- Would consume excessive memory / CPU to fit in any embedded system
- Does not take into account the limitations of real life deployments (ie: NetFlow is running on all routers)
- ... fundamental vs. applied research

Q and A

Sharing Thoughts with the Research Community

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Interaction With the Research Community

- Cisco is active with the research community
  - Sponsoring research
  - Sponsoring and attending workshop/conference
  - Reading papers
  - Discussing papers internally
  - Etc…

A new way to Sponsor Research Topcis

- University Research Program (URP) will disappear
- http://www.cisco.com/go/research

  Under development

  Propose some research topics

  “Researcher-initiated investigations, to address topics of your choice and mutual interest.” at any time
- Example: Application Flow Management and Service Assurance

  There are few tools that relate end-user Quality of Experience (QoE) to measurable network behavior. Historically, keeping per-flow information that might help connect individual resource consumption with QoE has been prohibitively expensive. However, new measurement techniques may help the situation. The question is, can we develop data management, correlation and performance policy management techniques that allow us to infer and manage end-user QoE from per flow and individual resource measurements?

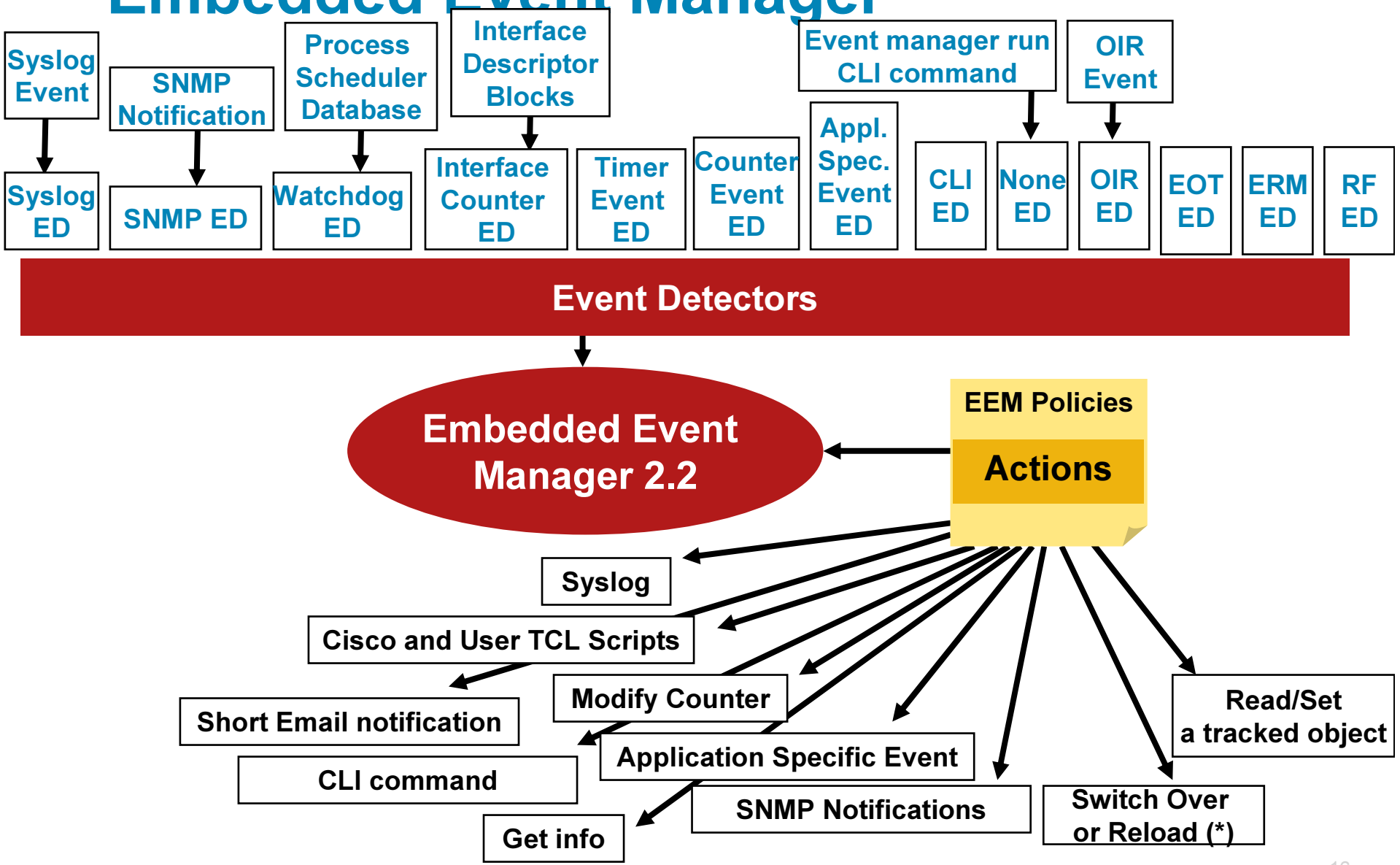
(Future) Principles of Fault Management in Devices

- Quick fault detections is strategic to network management
- Systematic network element polling doesn't always scale
- Let's put some more NMS intelligence into the network elements
  - Embedded management starts to be important
- Let's tune the right fault management events from the network elements themselves
- There are ways in the router to move in the direction of device level policy based management

Device Instrumentation in Routers

Interface Index Display
CB-QOS-MIB Index Enhancement
Individual Notification Filtering
Configuration Replace and Rollback
OER
Embedded Event Manager
NetFlow
NBAR
Command Scheduler
Enhanced Object Tracking
Config Generation Perf. Enhancement
Interface Alias Long Name Support for SNMP
EVENT & EXPRESSION MIB
Enhanced Object Tracking for IP SLA
SNMP OID statistics
NOTIFICATION-LOG-MIB
All IP SLA features
Corvil
UDI Retrieval
Memory Threshold Notification
NetFlow Export in a VRF
Contextual Configuration Diff Utility
RMON Event and Alarm
SNMP Utility in the Router
TCL
Config lock
Config logger Persistency
Embedded Resource Manager
IOS Defaults Exposure
Interface Range
Data Collection Mechanism
Auto-Secure
Syslog Writing to Flash
Configuration Change Notification and Logging
Reliable syslog

Device Level Policy Based Management Embedded Event Manager



The “interesting” Research Topics

- http://www.cisco.com/go/research
- My interest

  Self-managed network services, in which the network combines a number of features together to create services without NMS intervention
- Interesting research topics
  1. The research topics with a good business case

     Fundamental vs. applied research

     Don’t hesitate to ask …
  2. The research topics combining results
  3. The research topics that could be implemented in the routers

     Don’t hesitate to ask …
- Two examples:

  IP SLA research

  Sampled NetFlow accuracy

Q and A