Advancing Metrics on the Standards Track:

RFC 2680 (Loss) Test Plan and Results

draft-morton-ippm-testplan-rfc2680-02

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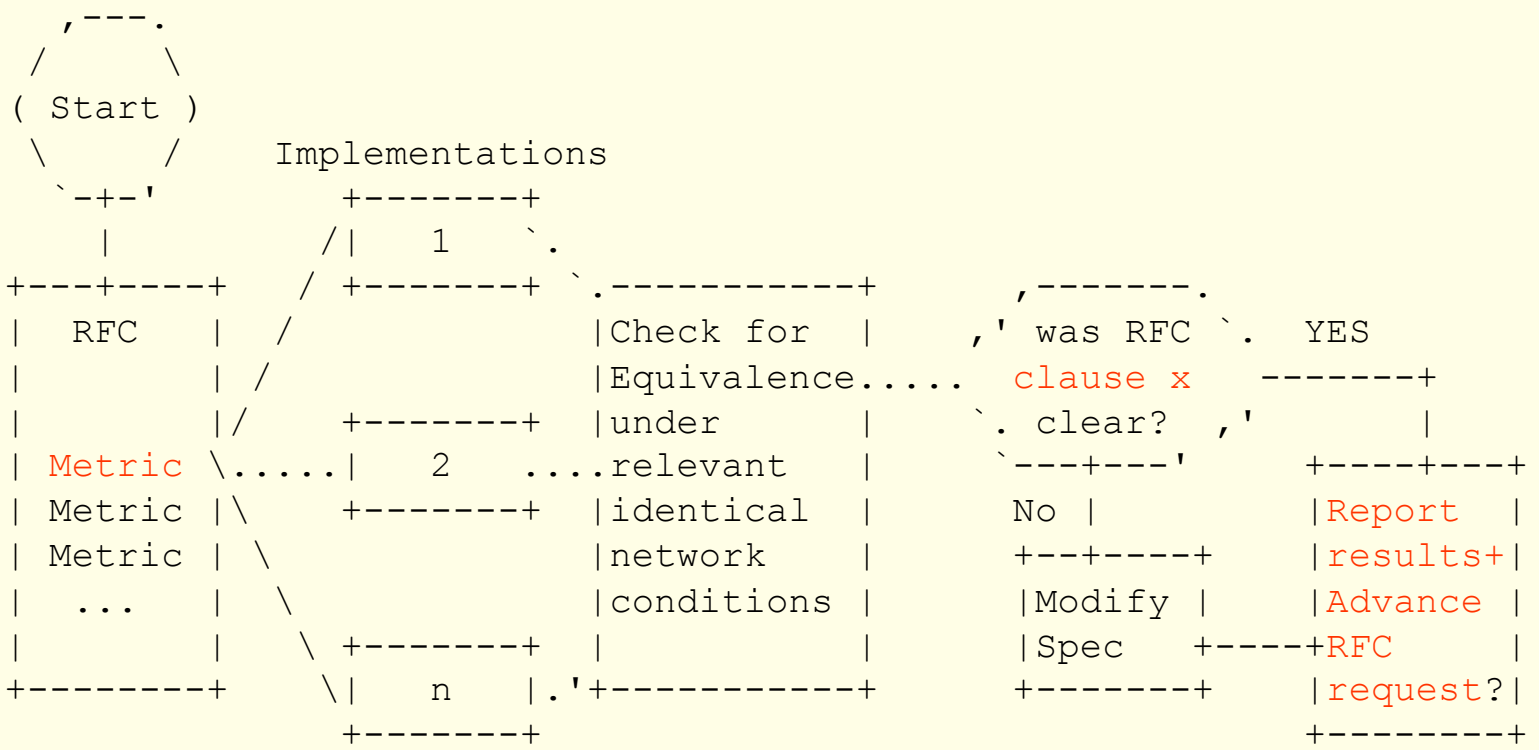
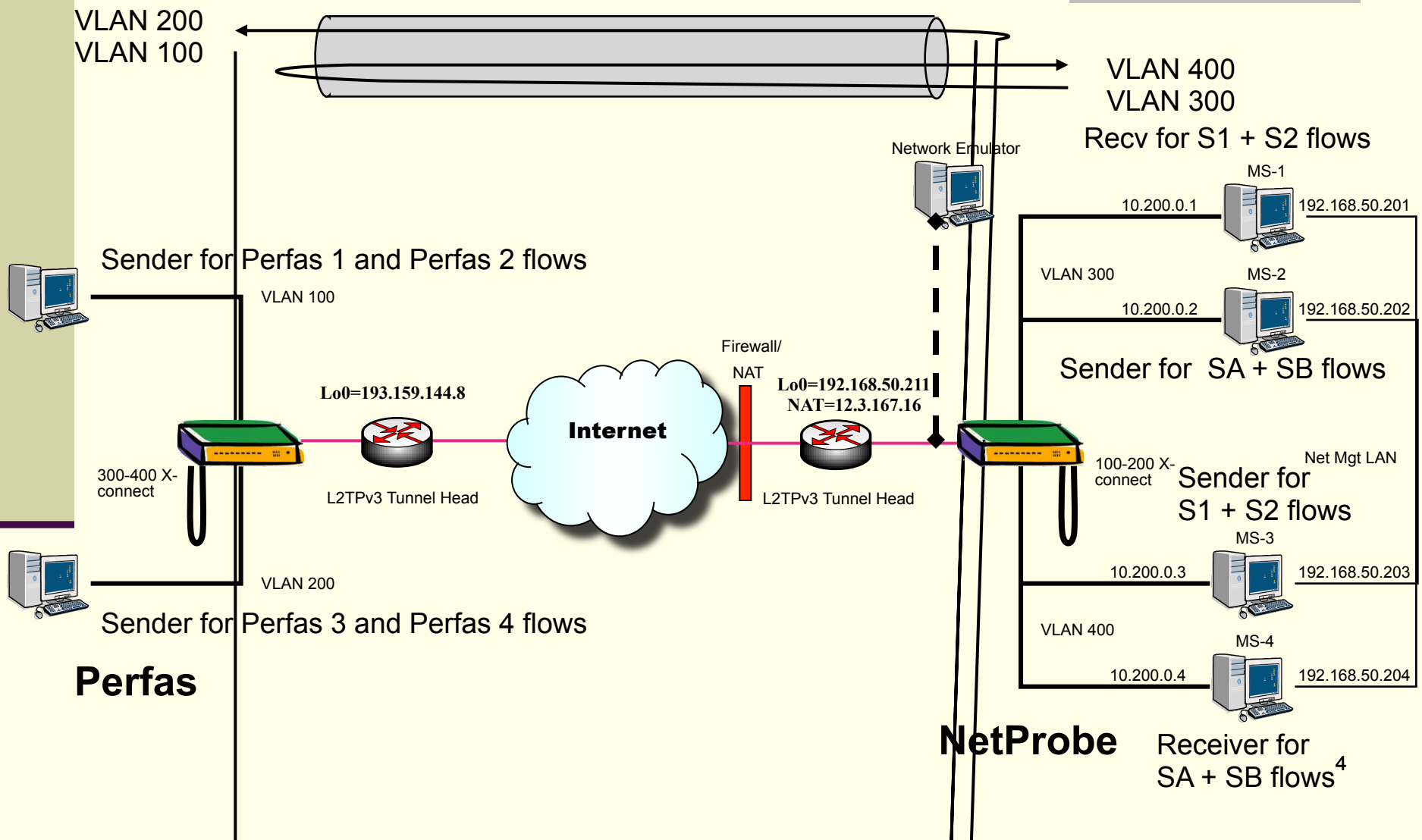
Outline

- Implement the Definition-centric metric advancement described in RFC 6576 (to be?)
- Test Plan Overview
  - Test Set-up and Specific Tests
- Test Results
- Summary and implications on the text of the revised RFC2680

Definition-Centric Process



Test Configuration



Overview of Testing

- 32 different experiments conducted from March 9 through May 2, 2011.
- Varied Packet size, Active sampling distribution, test duration, and other parameters (Type-P)
- Added Network Emulator “netem” and varied fixed and variable delay distirbutions
  - Also inserted loss in a limited number of experiments.

Overview of Testing (sample)

Date	Samp	Interval	Duration	Notes	ADK same	ADK cross
Mar 23	Poisson	1s	300s	Netem 10% Loss		
Mar 24	Periodic	1s	300s	Netem 100ms +/- 50ms delay		
Mar 24	Periodic	1s	300s	Netem 10% Loss		Pass
Mar 28	Periodic	1s	300s	Netem 100ms		
Mar 29	Periodic (rand st.)	1s	300s	Netem 100ms +/- 50ms delay, 64 Byte	NP s12AB Per p1234	Pass combined
Apr 6	Periodic (rand st.)	1s	300s	Netem 100ms +/- 50ms delay, 340 Byte		
Apr 7	Periodic (rand st.)	1s	1200s	Netem 10% Loss		Pass
Apr 12	Periodic (rand st.)	1s	300s	Netem 100ms, 500 Byte and 64 Byte comparison		

Threshold and Correction Factors

- For ADK comparison: cross-implementations
  - 0.95 confidence factor at 1ms resolution, or
  - The smallest confidence factor & res. of *same* Implementation
- For Anderson-Darling Goodness-of-Fit (ADGoF) comparisons:
  - the required level of significance for Goodness-of-Fit 11.4 of [RFC2330]
  - 11.4 of [RFC2330]
  - This is equivalent to a 95% confidence factor

For ADK comparison: cross-implementations

Tests in the Plan

6. Tests to evaluate RFC 2680 Specifications
   - 6.1. One-way Loss, ADK Sample Comparison
     - 64 and 340 Byte sizes
     - Periodic and Poisson Sampling
   - 6.2. One-way Loss, Delay threshold
   - 6.3. One-way Loss with Out-of-Order Arrival
   - 6.4. Poisson Sending Process Evaluation
   - 6.5. Implementation of Statistics for One-way *Delay* – Should be Loss

ADK for Loss Counts with 10% netem loss – Cross-Implementations

340B 1s Periodic	ti.obs	P-value*
not adj. for ties	0.52043	0.20604
adj. for ties	0.62679	0.18607
64B 1s Periodic		
not adj. for ties	0.76921	0.16200
adj. for ties	0.90935	0.14113
64B 1s Poisson**		
not adj. for ties	2.15099	0.04145
adj. for ties	1.93129	0.05125

, Red = failed

**Some samples were passed through a netem emulator

** Streams made two-passes through a netem emulator

- Calibration – completed for both implementations
- Calibration – completed for both implementations

both implementations (used results in RFC2679 plan)

- Suggest ______ text to allow this in RFC

- text to allow this in RFC
  - Loss with Reordering
  - Loss Count Pass ADK
  - Note: independent delay 2 sec +/- 1 sec
- as before.
  - Poisson Distribution AD GoF, multiple sample sizes
- Both NetProbe and Perfas pass in both sample sizes
  - Delay Stats – There's only one:
  - Both Implementations report (as ratio)
  - Type-P-One-way-Loss-Average <= sense to -Ratio

Summary

Two Implementations: NetProbe and Perfas+

- the basis of Advance RFC Request

  Criteria for Equivalence Threshold & correction

  Experiments complete, key clauses of

- Two revisions to the RFC suggested from this
- Two revisions to the RFC suggested from this study

References

language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN http://www.R-project.org/.

Sample-Anderson-Darling Tests, *Journal of the American Statistical Association,* **Vol 82, No. 399**, 918–924.

Sample-Anderson-Darling Tests, *Journal of the American Statistical Association,* **Vol 82, No. 399**, 918–924.

BACKUP

Backup Backup Backup

ADK tests – Glossary & Background

ti.obs is calculated, an observed value based on an ADK metric. The absolute ti.obs value must be less than or equal to the Critical Point.

Critical Point.

The P-value or (P) in the following tables is a statistical test to bolster confidence in the result. It should be greater than or equal to $\alpha = 0,05$.

For k = 2 samples, the Critical Point is 1.955 for the Confidence Interval of 95% (or $\alpha = 0.05$)

For k = 9 samples, the Critical Point is 1.839

(Note, the ADK publication doesn't list a Critical Point for 8 samples, but it can be interpolated)

, Red = ADK test failed

Percentiles of the ADK Criteria for various sample
Percentiles of the ADK Criteria for various sample
combinations (k= number of samples)

m m (k-1)	0.75 0.75 α=0.25	0.90 0.90 α=0.1	0.95 0.95	0.975 0.975	0.99 0.99
		1.225	1.960	2.719	3.752
2		1.309	1.945	2.576	3.414
3	.498	1.324	1.915	2.493	3.246
4	.525	1.329	1.894	2.438	3.139

Criteria met when |t.obs| < ADK Criteria(%-tile of interest)
Criteria met when |t.obs| < ADK Criteria(%-tile of interest)

Test Set-up Experiences

- Test bed set up may have to be described in more detail.
- We've worked with a single vendor.
  - Selecting the proper Operation System took us one week (make sure support of L2TPv3 is a main purpose of that software)
  - Connect the IPPM implementation to a switch and install a cable or internal U-turn on that switch. Maintain separate IEEE 802.1q logical VLAN interfaces between connecting the switch to the CPE and terminate the L2TPv3 tunnel.
  - The CPE requires at least a route-able IP address as LB0 interface if the L2TPv3 tunnel spans the Internet
  - The Ethernet interface MUST be cross connected to the L2TPv3 tunnel in port mode
  - Terminate the L2TPv3 tunnel on the LB0 interface.

NetProbe 5.8.5

- Pre-dates *WAMP, functionally similar
- Software-based packet generator including Loss, Delay, PDV, Reordering, Duplication, burst loss, etc. in post-processing on stored packet records
- Provides performance measurements including Loss, Delay, PDV, Reordering, Duplication, burst loss, etc. in post-processing on stored packet records

Section 6.2 – Loss Threshold

- See Section 2.8.2 of [RFC2680].
- 1. configure a path with 1 sec one-way constant delay
- See Section 2.8.2 of [RFC2680].
- 1. configure a path with 1 sec one-way constant delay
  2. measure (average) one-way delay with 2 or more
- or change the
  3. configure the path with 3 sec one-way delay (or change the delay while test is in progress, measurements in step 2)
- 4. repeat measurements
  5. observe that the increase measured in step 4 caused all