Using SMF to Measure APPN/HPR
at
Bank of America

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Session 7900

Agenda

- Introduction
  - Overview of IBM Mainframe Networking Evolution
  - Impact on Performance Analysis
    - IBM360 and Roll Your Own Teleprocessing
    - IBM SNA with CICS and IMS
    - IBM SNA Coexistence with Multiprotocol LANS
    - SNA over IP (Enterprise Extender/HPR)
    - *TCPIP as a Core Mainframe Network Technology*

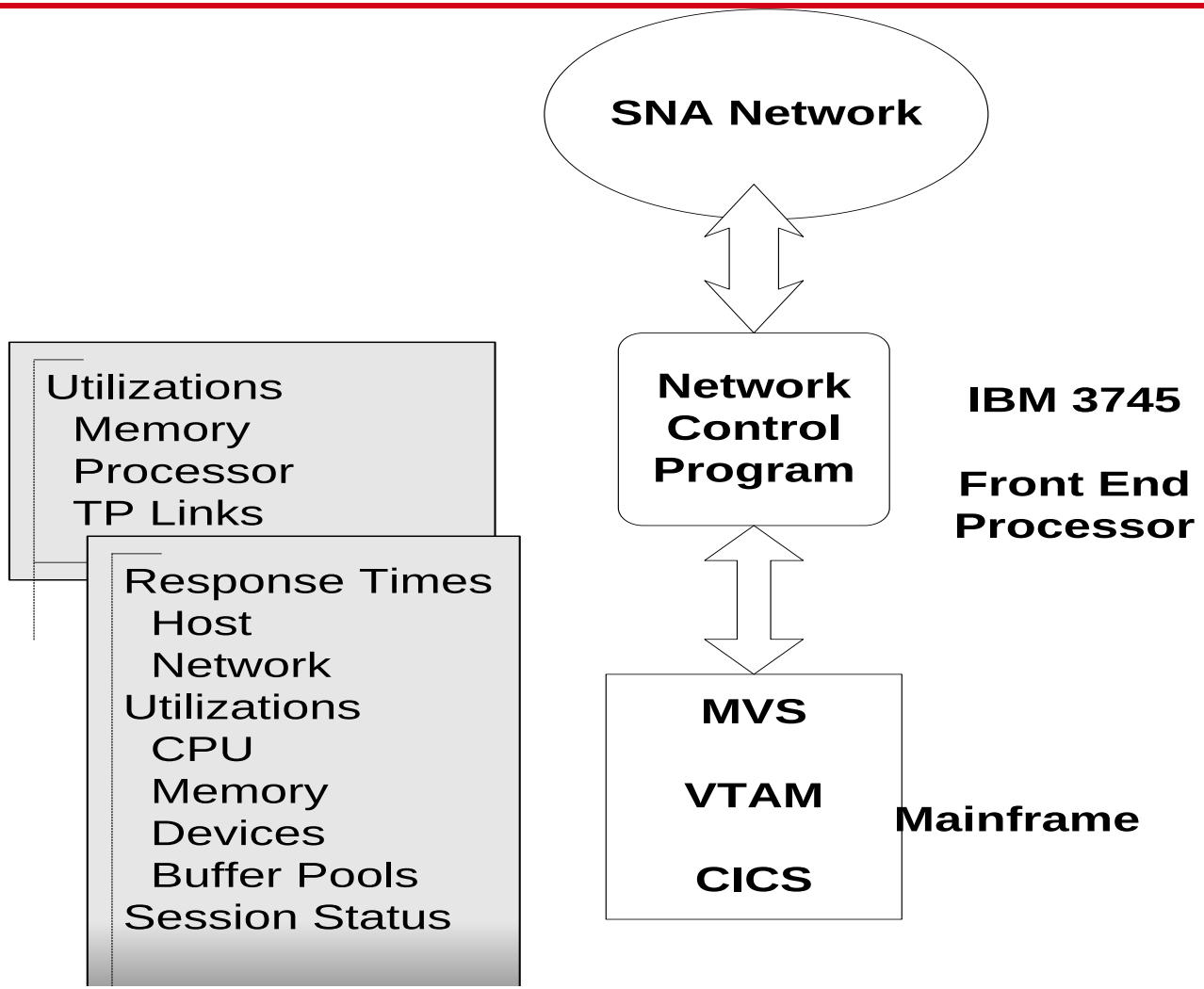
Mainframe Networking Evolution
SYSTEM 360 to DB/DC

- IBM 360 Architecture ushered in online apps.
  - Telecom devices were controlled via “Front Ends” that reduced load on Mainframe.
  - IBM provided “Access Methods” BTAM & QTAM for building OLTP Applications.
  - Performance Analysis focused on optimizing expensive CPU cycles and Telecom lines. It consisted mainly of adjusting polling intervals and maximizing the number of drops on a telecom line.
  - Simulation tools like TPAD and GPSS for impact on CPU and Peripherals
    - (Networks ran on CPUs rated less than 1 MIP)
- SNA Architecture , TCAM, CICS and IMS replaced Roll Your Own OLTP
  - Front Ends became more intelligent
    - Required Performance management and Capacity planning
  - Dedicated Mainframe Networks continued to expand
    - SNA had a number of tuning controls.
    - CPU’s grew to a few MIPS and Multiprocessors appeared.
    - Software and Hardware Monitors were used for efficiencies.
  - Tools became available to measure utilizations, response times, session status etc.
  - “SNAPSHOT” in Raleigh for simulation before implementation.
- Point to Point configurations simplified management.
  - Relatively easy to spot performance problems.
  - Queuing Theory formulas applied.

SNA Performance Management

- SNA
  - VTAM Measure & Tune Host resources
  - FEPS 3745 resources
    - » CCU
    - » Memory
    - » Buffers….
  - Links SDLC Line Utilizations
    - » Token Ring Adapter utilizations
    - » Pools etc
  - Methodology- Set thresholds and monitor with software monitors (i.e. NPM & Netview)
  - Analyze time spent on the network and in applications.

Basic SNA Configuration and Measurements



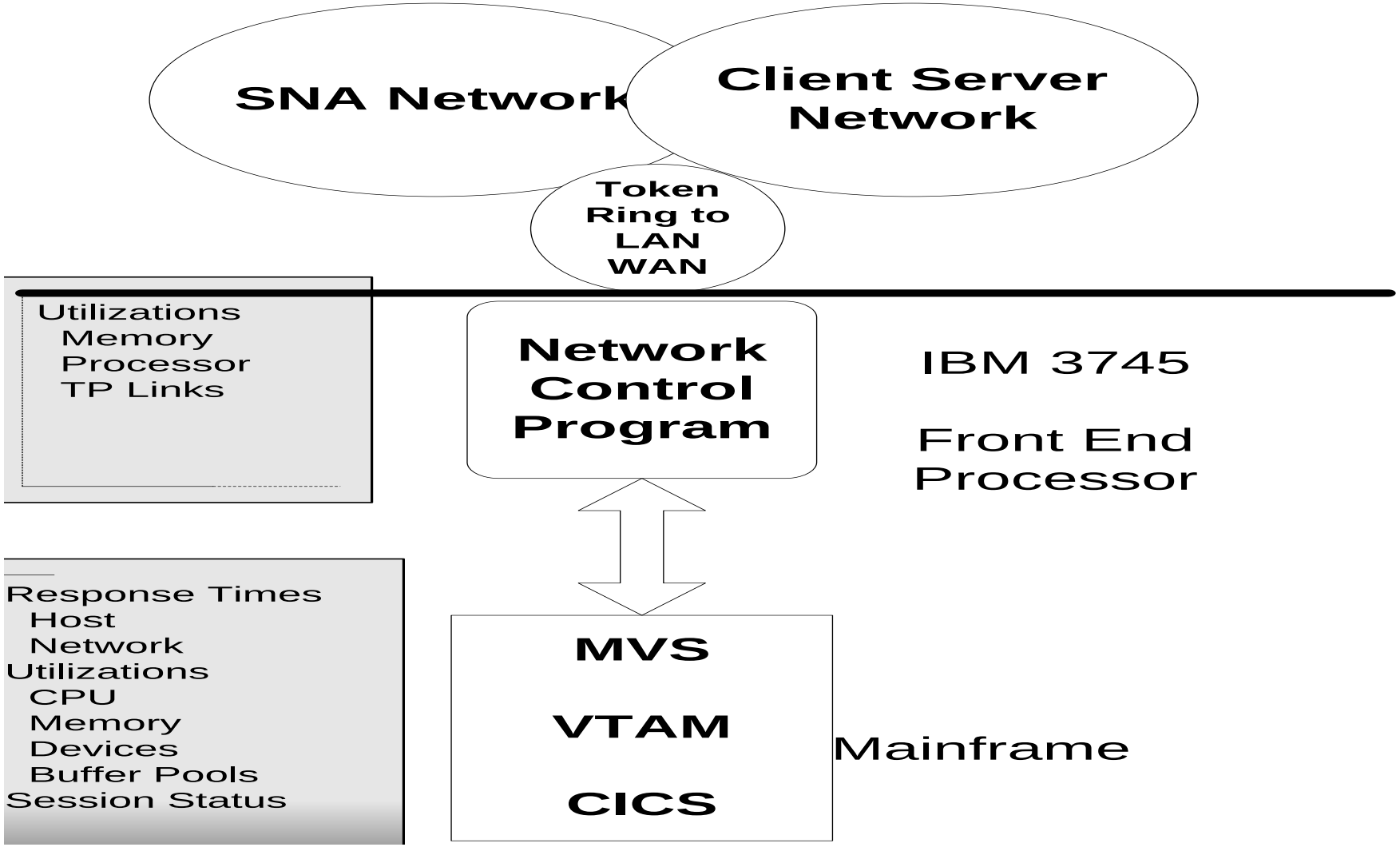
Point to Point Measurement

SYSID	Hr	AVG %LINE BUSY SENDING	MAX %LINE BUSY SENDING	AVG %LINE BUSY RECEIVING	MAX %LINE BUSY RECEIVING	AVG BYTES SENT	MAX BYTES SENT	AVG BYTES RECEIVED	MAX BYTES RECEIVED
Central	10	0.28	0.95	0.39	1.37	994,752	3,904,059	5,064,508	19,204,245
Line20	11	0.15	0.49	0.06	0.13	1,807,282	7,164,512	37,733	75,379
	12	0.14	0.42	0.06	0.12	1,144,634	4,506,760	32,866	53,633
	13	0.11	0.28	0.06	0.09	723,138	2,820,899	128,279	427,786
	14	0.14	0.29	0.12	0.31	1,021,790	3,964,175	1,133,796	4,445,345
	15	0.08	0.19	0.05	0.07	596,244	2,320,240	26,789	38,522
	16	0.04	0.04	0.04	0.04	19,273	21,668	22,292	24,740
	17	0.21	0.71	0.07	0.18	2,537,507	10,093,429	39,681	91,516
	18	0.11	0.26	0.06	0.08	724,300	2,814,815	199,434	548,514
	19	0.32	0.89	0.48	1.69	1,005,147	3,721,111	5,273,290	20,331,193
	20	0.2	0.55	0.31	1.05	348,918	1,167,851	3,696,506	13,682,160
	21	0.12	0.35	0.05	0.1	1,337,168	5,294,794	31,155	62,218
	22	0.05	0.08	0.04	0.05	114,961	400,157	25,186	32,078
	23	0.09	0.24	0.05	0.08	638,180	2,494,276	27,005	38,342
						16,674,803	64,535,754	22,796,181	81,926,988

Multiprotocol LANs

- SNA Meets Client/Server
  - Along Came LAN Protocols (Chatty)
  - "SNA Gateways" IPX from Novell, Vines from Banyan
- Requirement for SNA to Share the Wire with Client/Server
  - Terms like "Broadcast Storms" were heard
- Performance Analysis required integrated LAN/WAN and SNA Systems management.
  - Multiple "owners"
  - Sniffers, RMON, Performance Reporting and Trending
- SNA Encapsulation (Data Link Switching)
  - Early Attempt to minimize impact of multiple protocols

SNA and Multiprotocol LAN/WAN



SNA Coexistence with Client Server

- SNA is a courteous protocol
  - If it runs into delays it slows down
  - If there is no prioritization on the LAN then SNA continues to concede bandwidth when competition increased.
- SNA Encapsulation provided some relief
  - DLSW encapsulated SNA in LAN protocol
- End to End Management
    - Required integration of LAN and SNA systems management.

Multiprotocol LAN/WAN Performance Management

- Probes on the Wire
  - Identified “Top Talkers”
  - Identified Bandwidth used by Various protocols
  - Provide a Historical View of Utilizations.
  - Not Integrated with SNA Reporting Systems
  - Required Trending Analysis of both measurement systems.

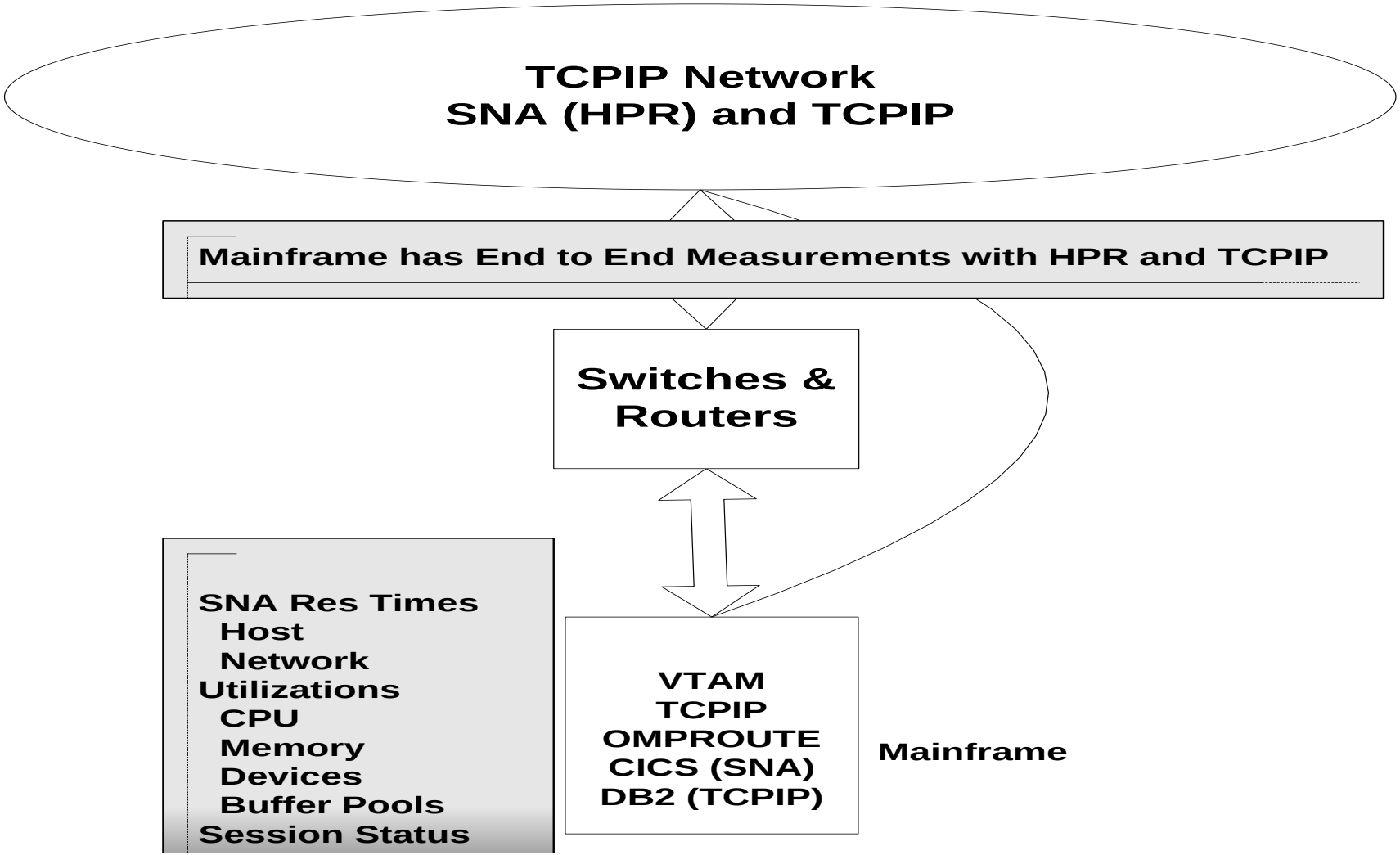
Today

- Host Applications (SNA and TCPIP Based)
- Communications Server (VTAM & TCPIP)
- Open System Adapters (OSAs)
- Switches & Routers
- Strategic direction is TCPIP
- Enterprise Extender allows Legacy SNA applications to utilize IP backbone

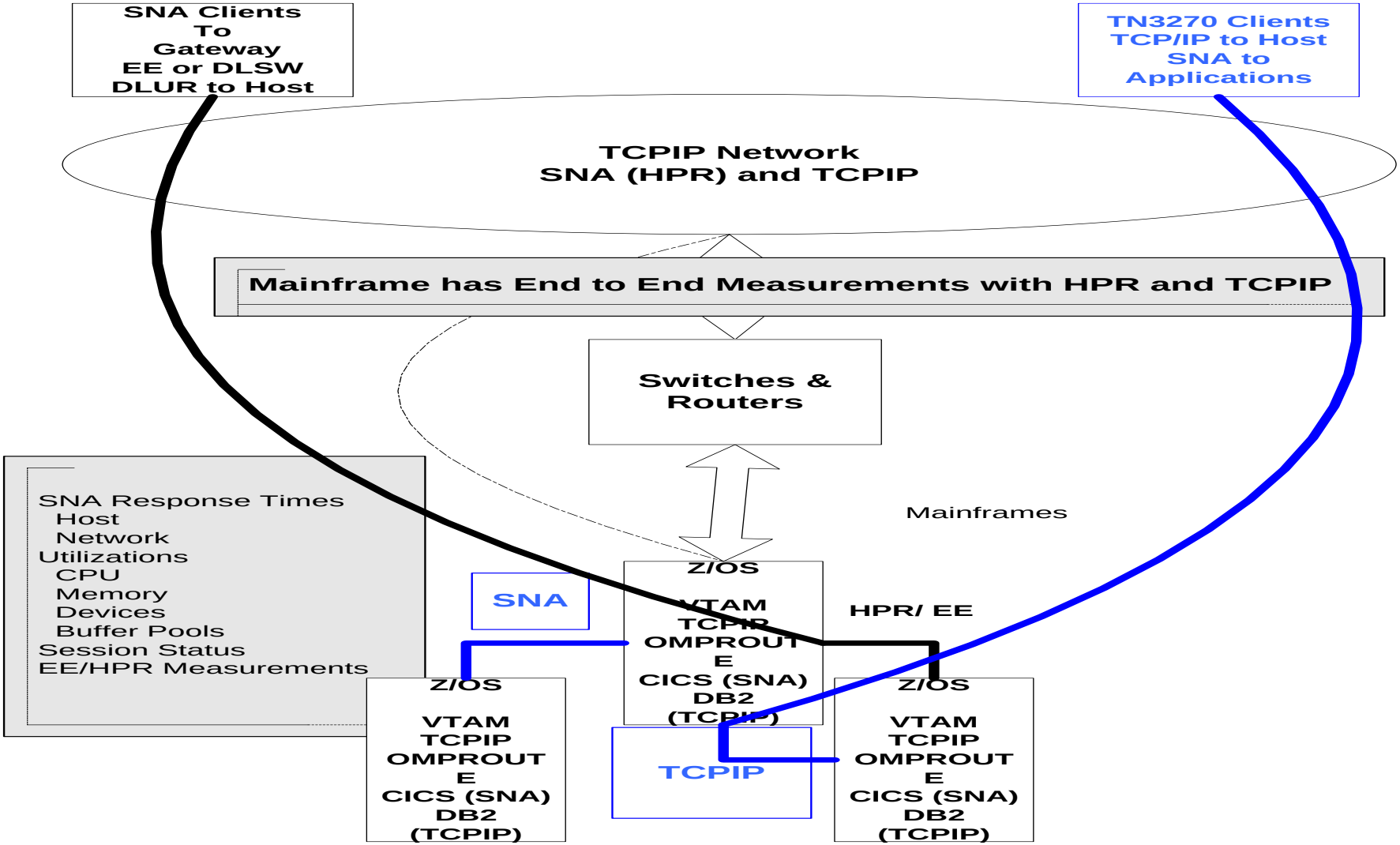
Mainframe Z/OS Communications Server 2010

- TCPIP
- VTAM
  - SNA on the Mainframe to support SNA Apps.
  - APPN/HPR Topology and Routing
  - Enterprise Extender (EE) Allows SNA over IP
    - IP thinks EE is another UDP application
    - Native IP routing
    - End to End failure protection and prioritization
  - Some New End to End Measurements

HPR and TCPIP Both over IP



TN3270 IP and EE Alternative 3270 Connectivity



Developing Baseline Measurements for EE/HPR

- Mainframe Network Measurements are captured in SMF
  - HPR/APPN NPM data SMF Type 28
  - HPR/APPN NLDM data SMF Type 39
  - UDP SMF Type 119
  - IP SMF Type 119
- Baseline measurements
  - Developed from Batch SAS reports

SMF Type 28 Subtypes

NPMCMNET	CM1	NCD	SMC/		01,03,53,55,A5	NETWORK COMMANDS
			PMC		02,04,54,56	
NPMCMDNC	CM2	ACD	SMC		40	DNC COMMANDS
NPMINNCP	IN1	NCD		NAC	10	NCP INTERVAL
NPMINPU	IN2	NCD		NADL	11,12	LINE/PU INTERVAL
NPMINLU	IN3	NCD		NADS	13	LU/TERM INTERVAL
NPMINNRT	INK	NCD		NRT	14	ROUTER INTERVAL
NPMINNRP	INL	NRP		NRP	15	CISCO POOL INTERVAL
NPMINTRI	IN9	NCD		TRI	70,71	NTRI LOG/PHY LINK
NPMINNEO	INA	NCD		NEO	72,73	NEO LINK/PU
NPMIN25L	INB	NCD		XLK	74	X.25 NPSI,XI LINK
NPMIN25P	INC	NCD		XPU	75	X.25 NPSI,XI PU
NPMINNVC	IND	NCD		XVC	77	NPSI VC
NPMINFRP	INE	NCD		FRP	82,83,84,85	FRAME RELAY
NPMSUMRY	SUM	CDS	SST	SSA	21,22,23,24,25,2A,	SUMMARY
					31,32,33,34,35	
NPMSESTR	SE1	SMA			48	SESSION START
NPMSEEND	SE2	SMA			49	SESSION Act END
NPMVTSTR	VTS	VCD	MVC		D0,D1,D2	VTAM START/STOP/MD
NPMVTEXC	VTE	VCD	VAM		D3,D4	VTAM EXCEPTION
NPMVSVEN	VEN	VCD		VEN	D5	VTAM ENVIRONMENTAL
NPMVSVGB	VGB	VCD		VGB	D6	VTAM GLOBAL
NPMVSVBF	VBF	VCD		VBF	D7	VTAM BUFFER POOL
NPMVSVDV	VDV	VCD		VDV	D8	VTAM DEVICE DATA
NPMVSVVR	VVR	VCD		VVR	D9	VTAM VIRTUAL ROUTE
NPMVSVAP	VAP	VCD		VAP	DA	VTAM APPLICATION
NPMVSVAD	VAD	VCD		VAD	DB	VTAM ASID DATA
NPMVSVCS	VCS	VCD		VCS	DC	VCS
NPMVSVTT	VTT	VCD		VTT	DD	APPN DATA
NPMVSVRT	**VRT**	**VCD**		**VRT**	**DE**	**VRT**
NPMVSVMN	VMN	VCD		VMN	DF	VMN

Subtypes Source Data and Application

- NPMVSVGB VGB VCD VGB D6 VTAM GLOBAL
  - CPU and Memory
- NPMVSVBF VBF VCD VBF D7 VTAM BUFFER POOL
- NPMVSVDV VDV VCD VDV D8 VTAM DEVICE DATA
  - Devices
- NPMVSVVR VVR VCD VVR D9 VTAM VIRTUAL ROUTE
- NPMVSVAP VAP VCD VAP DA VTAM APPLICATION
- NPMVSVAD VAD VCD VAD DB VTAM ASID DATA
- NPMVSVCS VCS VCD VCS DC VCS
- NPMVSVTT VTT VCD VTT DD APPN DATA
- NPMVSVRT VRT VCD VRT DE VRT
  - EE/EBN Performance and System Management

Examples of Fields in SMF Type 28 Subtype DE

```
004522   VRNUM   ='VIRTUAL*ROUTE*NUMBER'
004523   VRTASRC ='ALLOWED*SEND RATE*CHANGES'
004524   VRTBPACT='TIMES WHEN*BACK PRESSURE*WAS APPLIED'
004525   VRTBPAPS='TIMES WHEN*BACK PRESS*HPR PATH SWTCH'
004526   VRTBPAQD='BACK PRESSURE*QUEUE DEPTH*EXCEEDS'
004527   VRTBPATM='BACK*PRESSURE*APPLIED*TIME'
004528   VRTCOSNM='COS*NAME'
004529   VRTCRHOP='CURRENT*HOP*ct'
004530   VRTEXTIM='EXPECTED*INTERVAL*TIME'
004531   VRTHPPST='HPR*PATH*SWITCH*TIMER'
004532   VRTINTV ='INTERVAL*NUMBER'
004533   VRTLNCE ='LOCAL*NCE'
004534   VRTLTCID='LOCAL*TCID'
004535   VRTLULUS='ACTIVE*LU-LU*SESSIONS*USING RTP'
004536   VRTMXHOP='MAXIMUM*HOP*ct'
004537   VRTNBREC='BYTES*RECEIVED*OVER RTP'
004538   VRTNBSNT='BYTES*SENT*OVER RTP'
004539   VRTNRCPN='NEW*REMOTE*CP*NAME'
004540   VRTNRNID='NEW*REMOTE*NETWORK*ID'
004541   VRTPIUFR='FIRST-IN*SEGMENT*PIU-S*RECEIVED'
004542   VRTPIUFS='FIRST-IN*SEGMENT*PIU-S*SENT'
004543   VRTPIULR='LAST-IN*SEGMENT*PIU-S*RECEIVED'
004544   VRTPIULS='LAST-IN*SEGMENT*PIU-S*SENT'
004545   VRTPIUMR='MIDDLE-IN*SEGMENT*PIU-S*RECEIVED'
004542   VRTPIUFS='FIRST-IN*SEGMENT*PIU-S*SENT'
 004543   VRTPIULR='LAST-IN*SEGMENT*PIU-S*RECEIVED'
 004544   VRTPIULS='LAST-IN*SEGMENT*PIU-S*SENT'
 004545   VRTPIUMR='MIDDLE-IN*SEGMENT*PIU-S*RECEIVED'
 004546   VRTPIUMS='MIDDLE-IN*SEGMENT*PIU-S*SENT'
 004547   VRTPIUNR='NON*SEGMENTED*PIU-S*RECEIVED'
 004548   VRTPIUNS='NON*SEGMENTED*PIU-S*SENT'
 004549   VRTPSAOE='PATH SWITCH*ATTEMPTS*OTHER ENDPOINTS'
 004550   VRTPSAOP='PATH SWITCH*ATTEMPTS*OPERATOR*COMMAND'
 004551   VRTPSATV='PATH SWITCH*ATTEMPTS*FOR THIS VTAM'
 004552   VRTPU   ='RTP*PHYSICAL*UNIT'
 004553   VRTRCPN ='REMOTE*CP*NAME'
 004554   VRTRENLP='RETRANSMITTED*NLPS'
 004555   VRTRNCE ='REMOTE*NCE'
```

Example of NLDM Data found in SMF Type 39

ACTETIME='ACCOUNTING*PERIOD*END TIME'
ACTSTIME='ACCOUNTING*PERIOD*START TIME'
AVGRSPTM='AVERAGE*RESPONSE*TIME(SEC)'
BINDCODE='BIND FAILURE*OR UNBIND*REASON CODE‘
CBYTPRSC='CONTROL*BYTES*PRI TO SEC'
CBYTSCPR='CONTROL*BYTES*SEC TO PRI'
CLASSERV='CLASS*OF*SERVICE‘
CPIUPRSC='CONTROL*PIU*PRI TO SEC'
CPIUSCPR='CONTROL*PIU*SEC TO PRI' CBYTPRSC='CONTROL*BYTES*PRI TO SEC'
CBYTSCPR='CONTROL*BYTES*SEC TO PRI'
CLASSERV='CLASS*OF*SERVICE‘
LARBLNK ='LINK/CUA RESOURCE*CONTROL*BLOCKS'
LARBLNKM='LINK/CUA ARB*HIGHWATER*MARK'
LARBLU ='LU RESOURCE*CONTROL*BLOCKS'
LARBLUMX='LU ARB*HIGHWATER*MARK'
LARBMAX ='ARB*HIGHWATER*MARK'
LEVNDMID='DOMAIN ID*(NCCF ID)'
LEVNETIM='END OF*RECORDING*PERIOD'
LEVNPIUB='PIU TRACE*BUFFERS*PROCESSED'
LEVNPIUS='PIUS*PROCESSED'
LEVNSAWB='SAW*BUFFERS*PROCESSED'
LEVNSESE='SESSION*END*NOTIFICATIONS'
LEVNSESR='SESSIONS*RECORDED*TO VSAM'
LEVNSESS='SESSION*START*NOTIFICATIONS'
LEVNSTIM='START OF*RECORDING*PERIOD’

…Over 125 Fields

Simple Report by LPAR from Type 28 Records

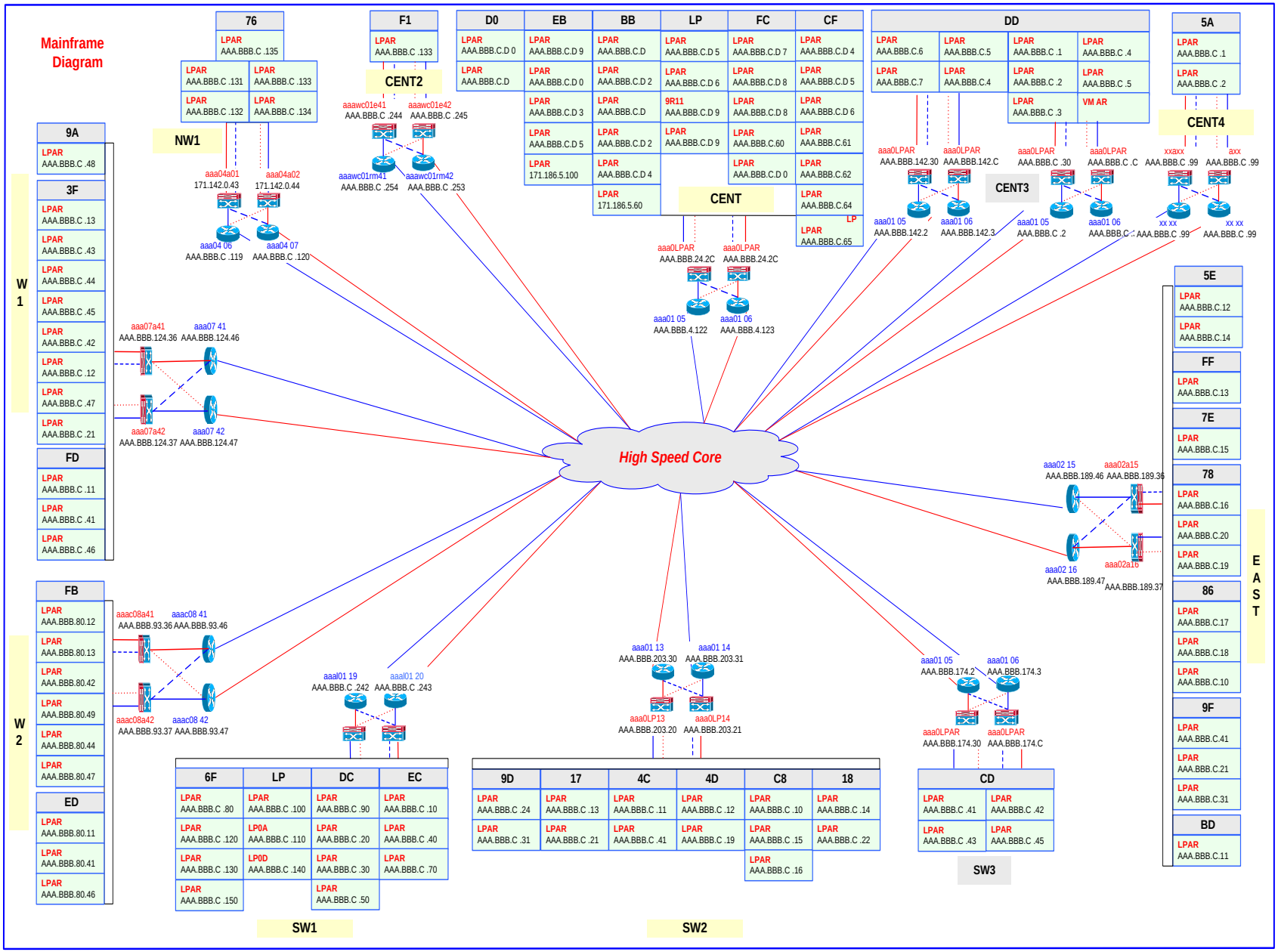
Sys	Mean R Trip Delay	Mean Act LU-LU Sess	LPAR Path SW Attempts	Unacknowledged Buffers	BYTES SENT RTP	BYTES RECV RTP
Cent-East14	42	16	10,082	56,247	3,123,146,522	8,419,954,044
East15	49	18	4,899	26,172	1,968,435,622	6,250,792,935
East1	36	92	946	18,868	5,467,387,689	6,028,000,781
East2	31	84	1,360	39,221	18,970,428,899	3,044,296,589
East3	30	180	1,829	41,602	10,625,968,336	1,330,523,271
All	38	57	23,729	353,327	114,663,849,120	34,362,142,431

Simple Report by Remote Network from Type 28

Sys	Netid	Mean Round Trip Delay	Max Round Trip Delay	Max Hop Count	Mean LU-LU Sess	LPAR Path Sw Attempts	Unacknowledged Buffers	Bytes Sent RTP	Bytes Recv RTP
VA14	EXTNET00	139	252	1	1	14	0	197,800	145,891
	INTNET1	59	79	2	2	165	947	62,043,308	63,508,901
	INTNET2	93	119	1	1	193	1,779	82,202,228	76,722,082
	EXTNET01	47	69	1	1	128	5	556,206	525,332
	EXTNET02	40	139	2	2	137	463	30,003,040	23,669,068
	EXTNET03	32	772	1	1	165	39	1,529,206	1,585,074
	EXTNET04	111	134	1	1	95	5	260,638	301,212
	EXTNET05	187	1,000	1	1	99	25	801,029	1,016,504
	EXTNET06	93	127	3	7	14	8	153,669	1,843,300
	EXTNET07	70	102	1	1	128	37	1,852,172	1,832,064
	EXTNET08	62	152	4	2	111	102	23,484,744	2,621,007
	EXTNET09	93	883	4	1	80	55	1,893,044	2,379,574
	EXTNET0A	34	1,000	2	14	134	1,166	15,680,346	146,972,649
	EXTNET0B	42	75	1	2	67	39	1,292,793	1,816,729
	EXTNET0C	38	780	2	18	8,552	51,577	2,901,196,299	8,095,014,65

Enterprise Network Management by Exception

- Enterprise consists of over 100 LPARs with EE/HPR clients.
- Production Reports and Thresholds used to identify performance issues.
- Daily exception reports produced.
- Supplemented with Netview based exception reporting and automated Emails to Performance Team members and on-call support.


Mainframe Diagram
76
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LPAR AAA.BBB.C .133
LPAR AAA.BBB.C .132
LPAR AAA.BBB.C .134
NW1
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aaa04a02 171.142.0.44
aaa04 06 AAA.BBB.C .119
aaa04 07 AAA.BBB.C .120
F1
LPAR AAA.BBB.C .133
CENT2
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aaawc01e42 AAA.BBB.C .245
aaawc01rm41 AAA.BBB.C .254
aaawc01rm42 AAA.BBB.C .253
D0
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LPAR AAA.BBB.C.D
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LPAR AAA.BBB.C.D 0
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LPAR AAA.BBB.C.D
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4D
LPAR AAA.BBB.C .12
LPAR AAA.BBB.C .19
C8
LPAR AAA.BBB.C .10
LPAR AAA.BBB.C .15
LPAR AAA.BBB.C .16
18
LPAR AAA.BBB.C .14
LPAR AAA.BBB.C .22
SW2
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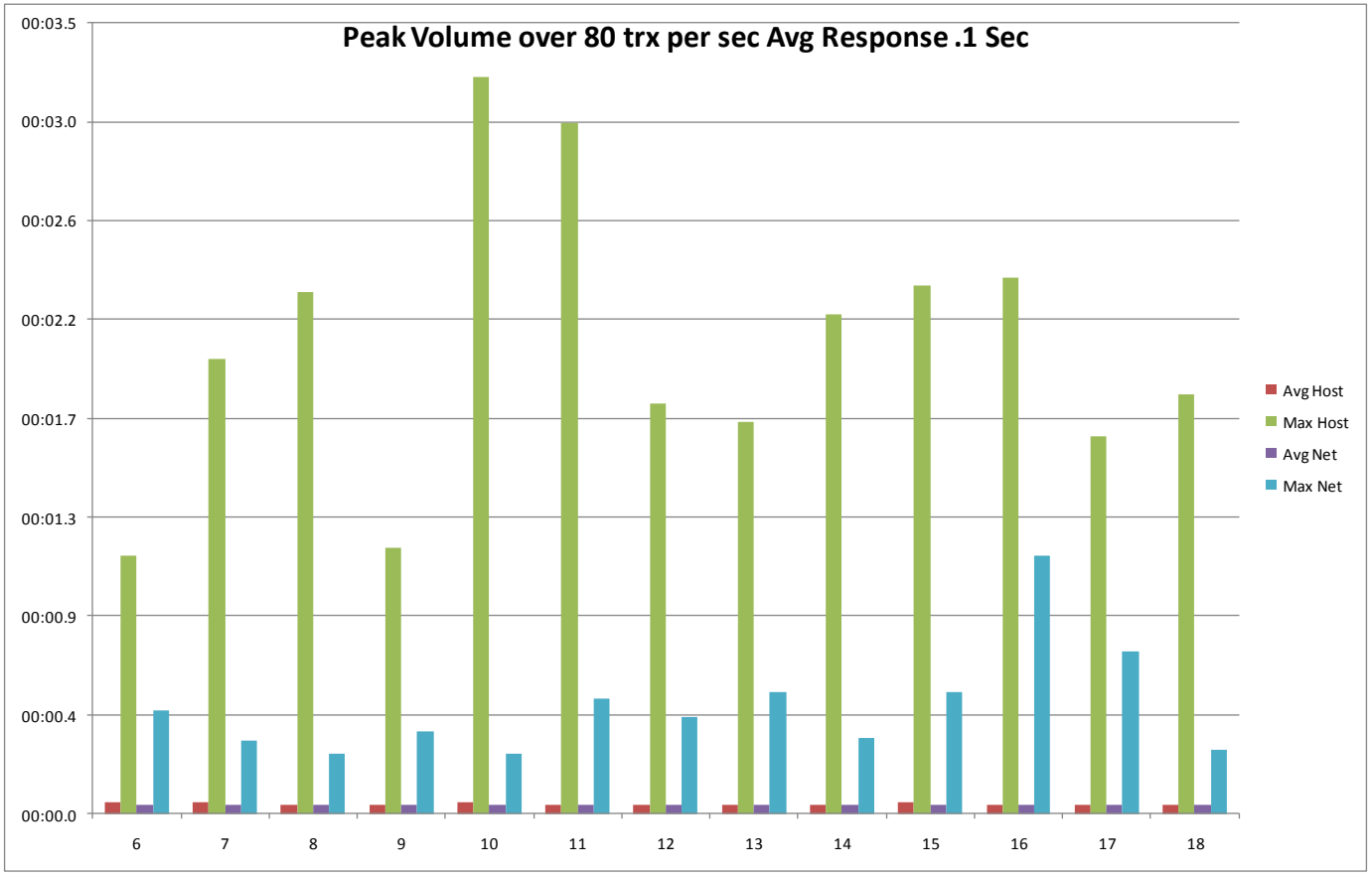
aaa01 06 AAA.BBB.174.3
aaa0LPAR AAA.BBB.174.30
aaa0LPAR AAA.BBB.174.C
CD
LPAR AAA.BBB.C .41
LPAR AAA.BBB.C .43
LPAR AAA.BBB.C .42
LPAR AAA.BBB.C .45
SW3

Peak Day Baseline Stats IMS Region based on NPM Data



Developing Thresholds

Looking for statistics that help with problem determination.

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Type 28 Fields that Measure Enterprise HPR Performance

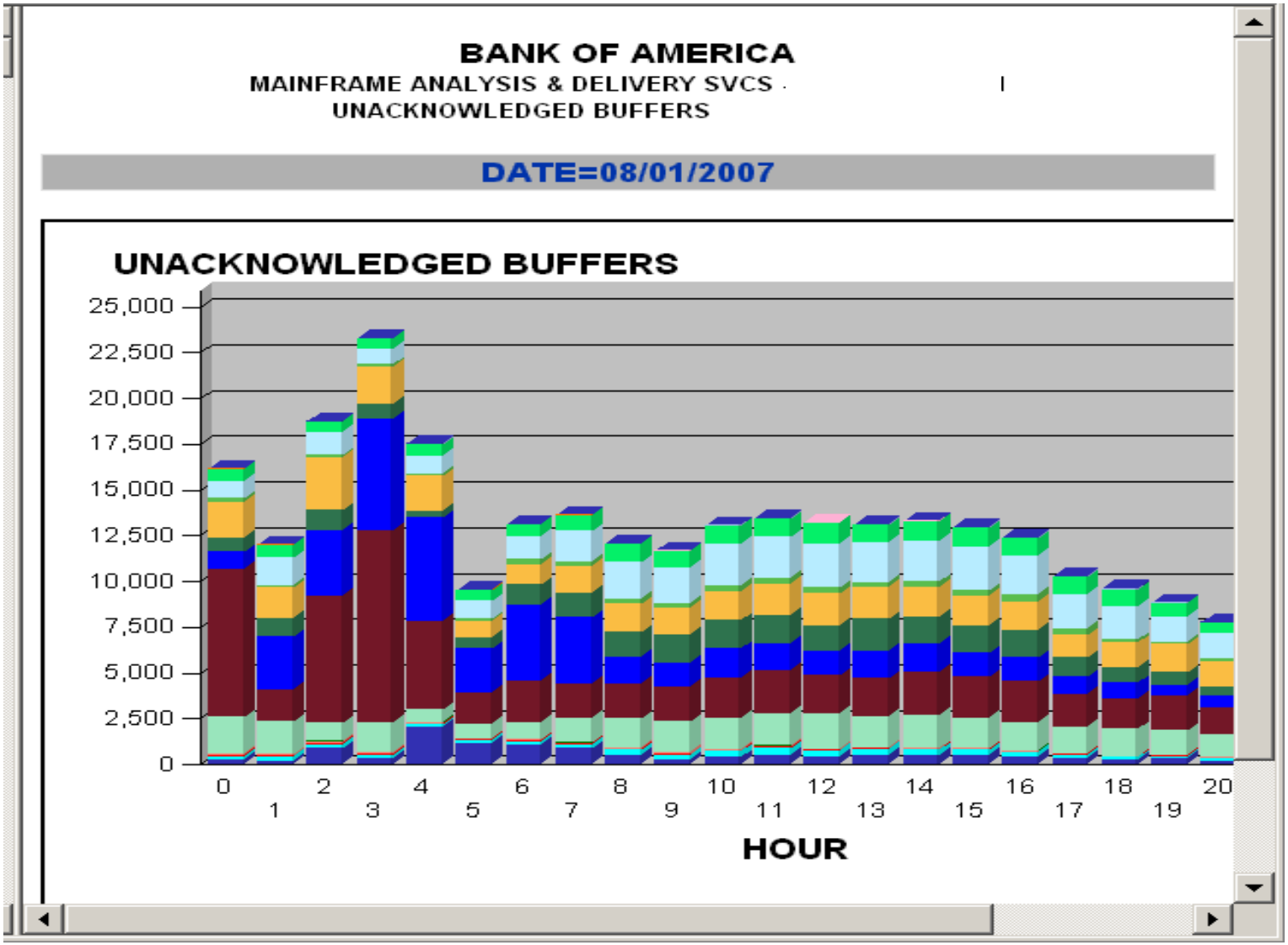
- Buffers sent over an RTP Pipe are kept in ECSA until acknowledged.
- If Buffers are not acknowledged then HPR adjusts send rate
- Look at
  - Allowed Service Rate Changes
  - Unacknowledged Buffers
  - Round Trip Delay
  - Retransmitted Network Layer Segments

Standard Reports

Graphs produced Daily with Measurements by LPAR

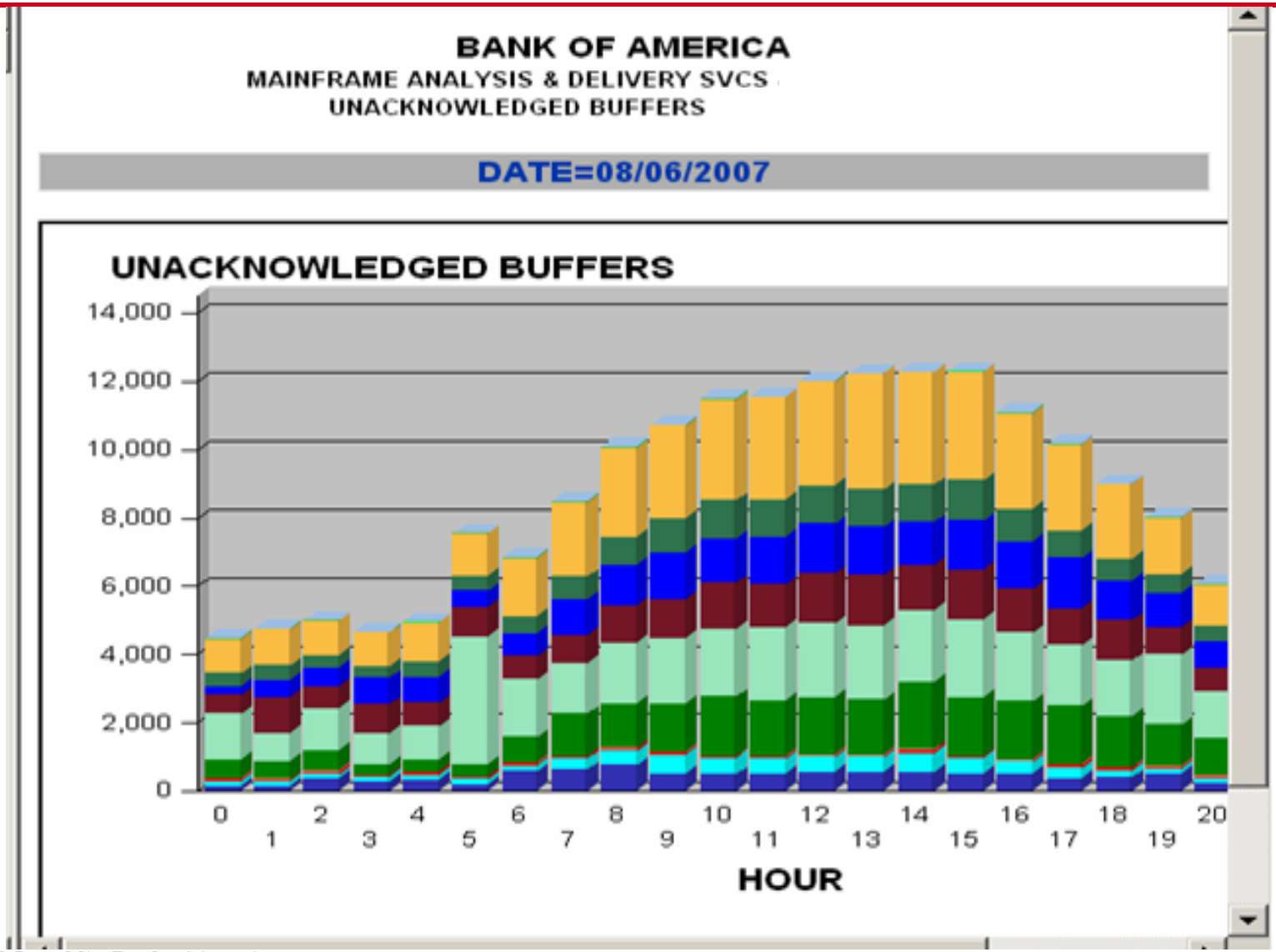
Bank of America

Unacknowledged Buffers Standard Report SYS1 Lt Blue 2000-2400 SYS2 Brown GT 10000 at 3AM SYS3 Blue SYS4 Green SYS5 Yellow



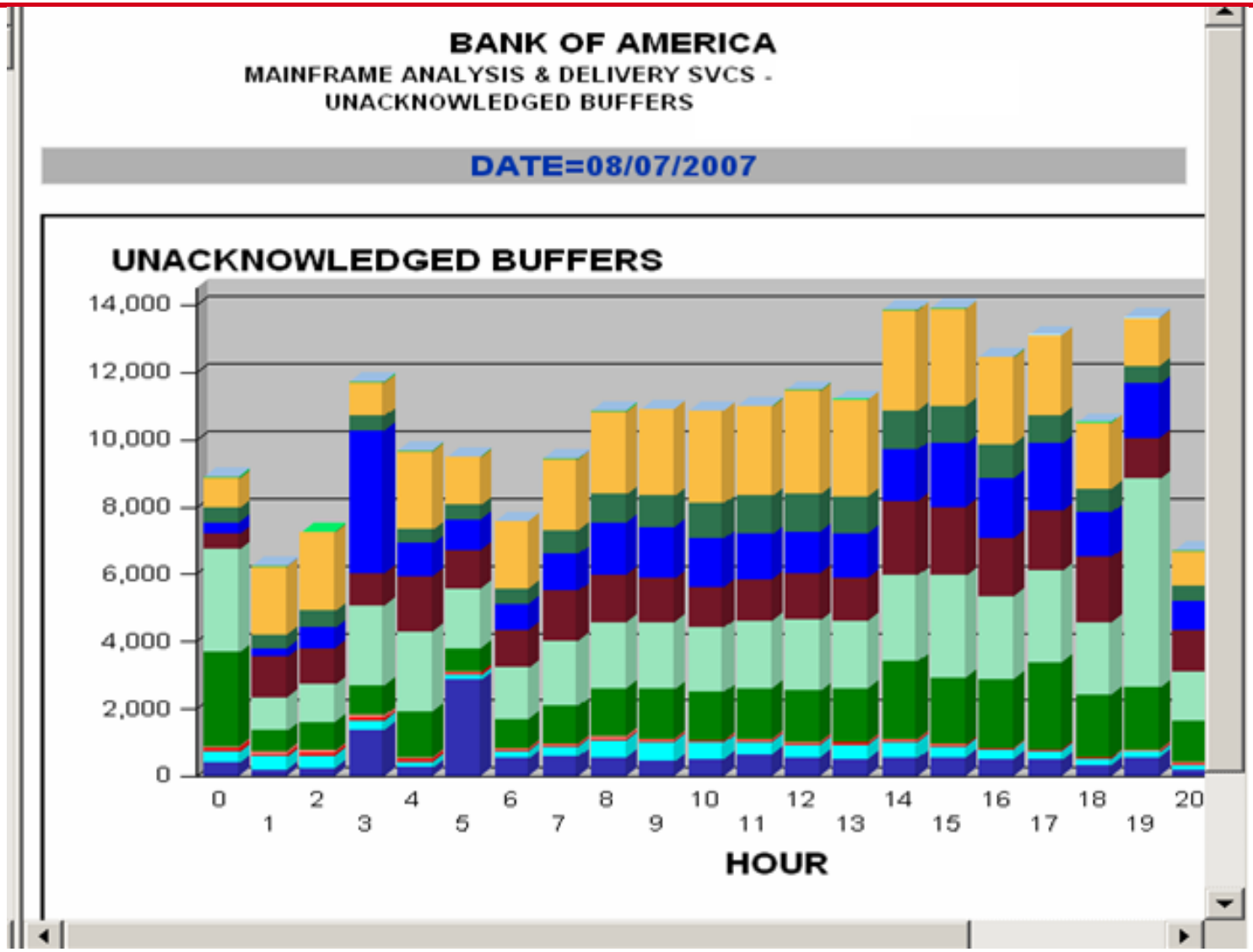
Unacknowledged Buffers Standard Report

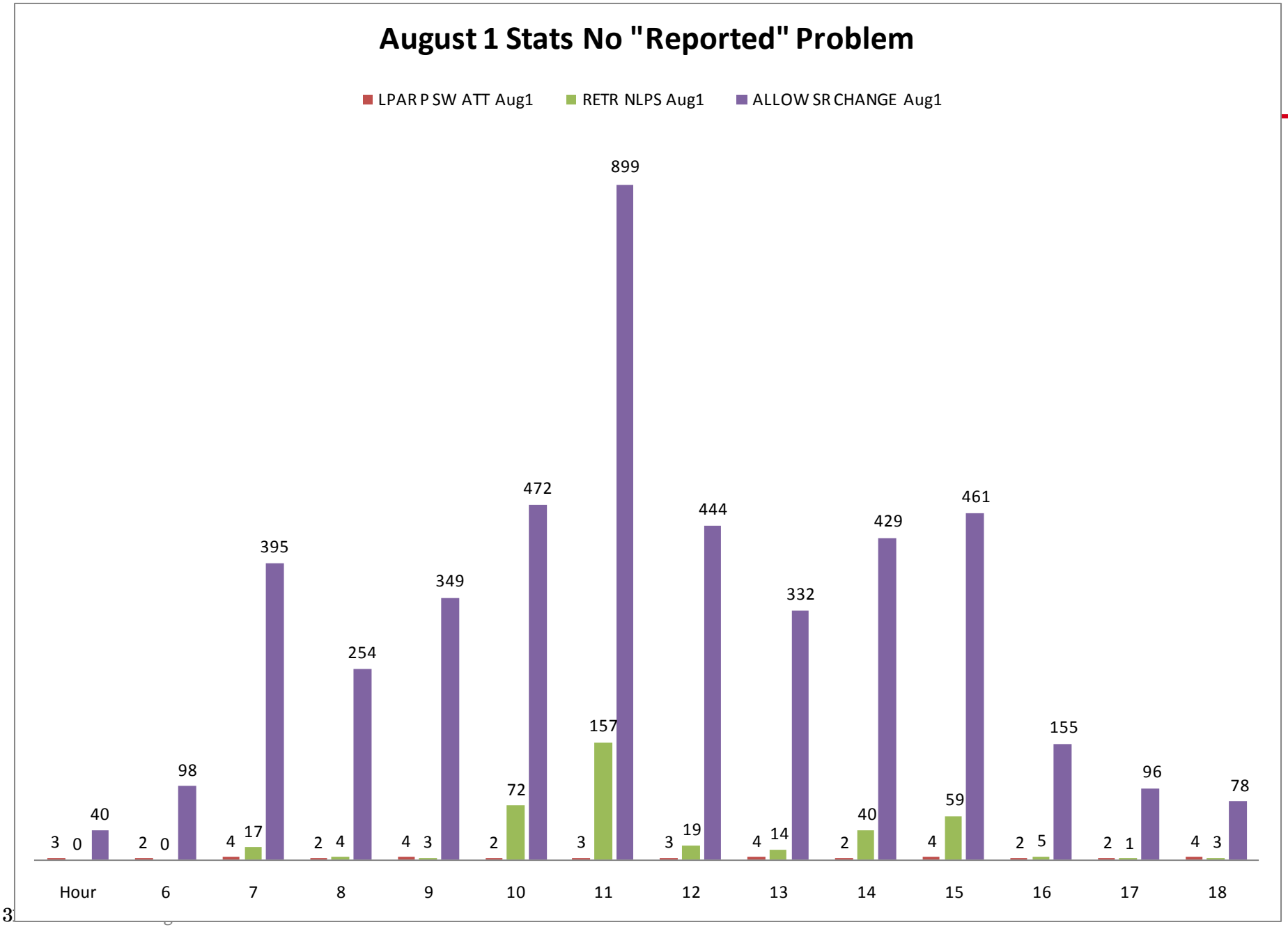
SYS1 Yellow 2600-3400 SYS2 Lt Blue, SYS3 Brown, SYS4 Blue, SYS5 Green

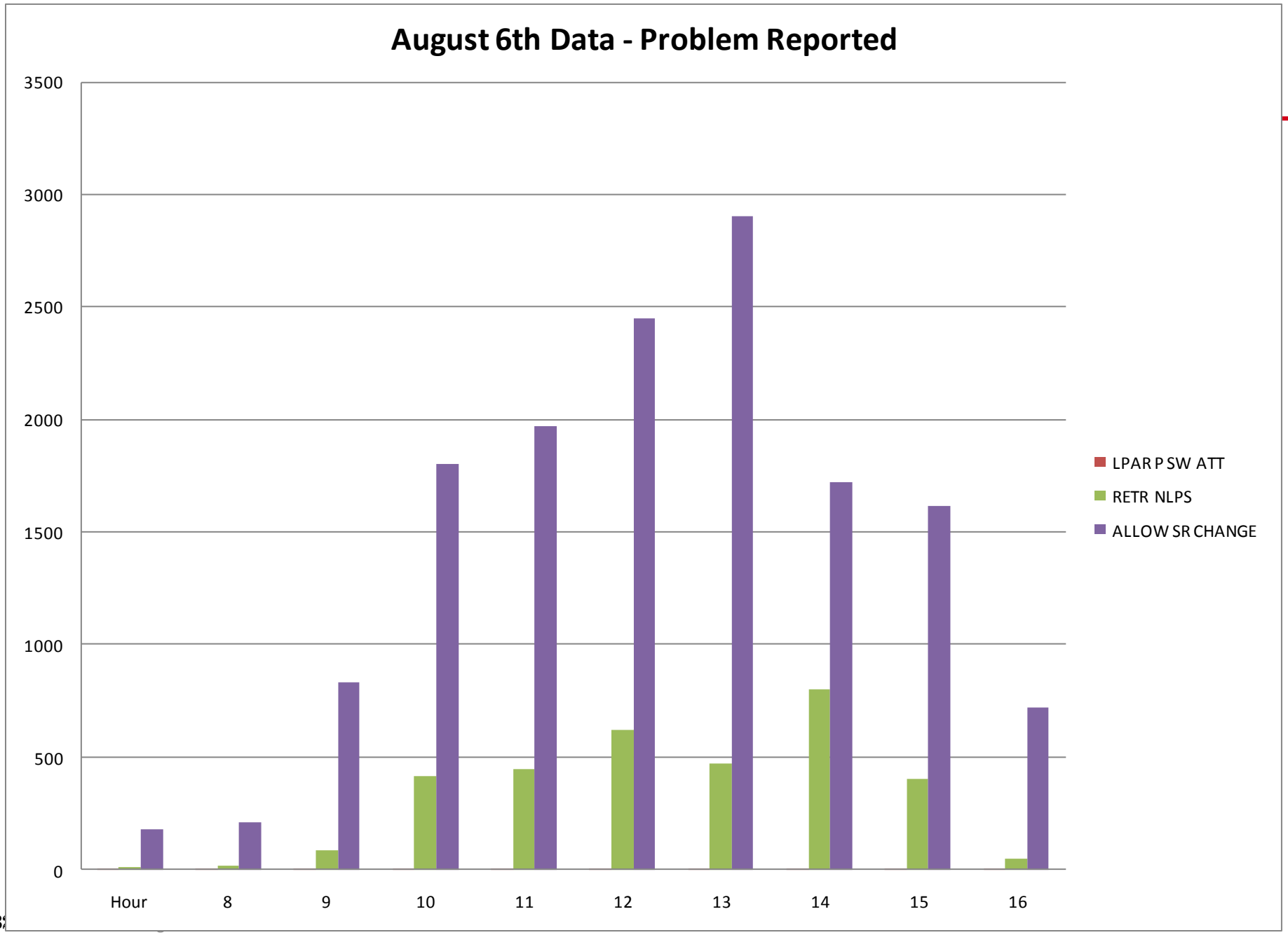


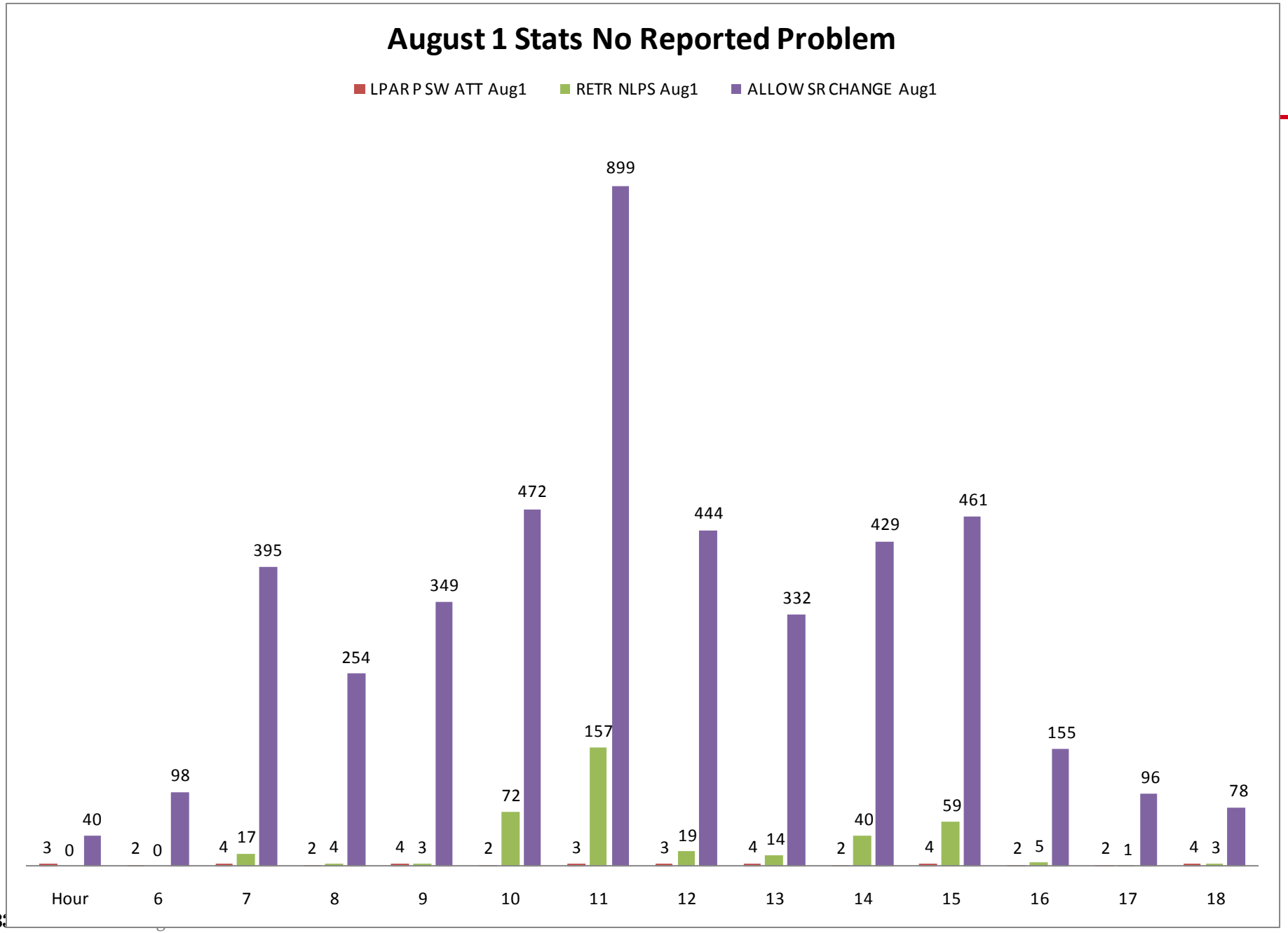
Unacknowledged Buffers Standard Report

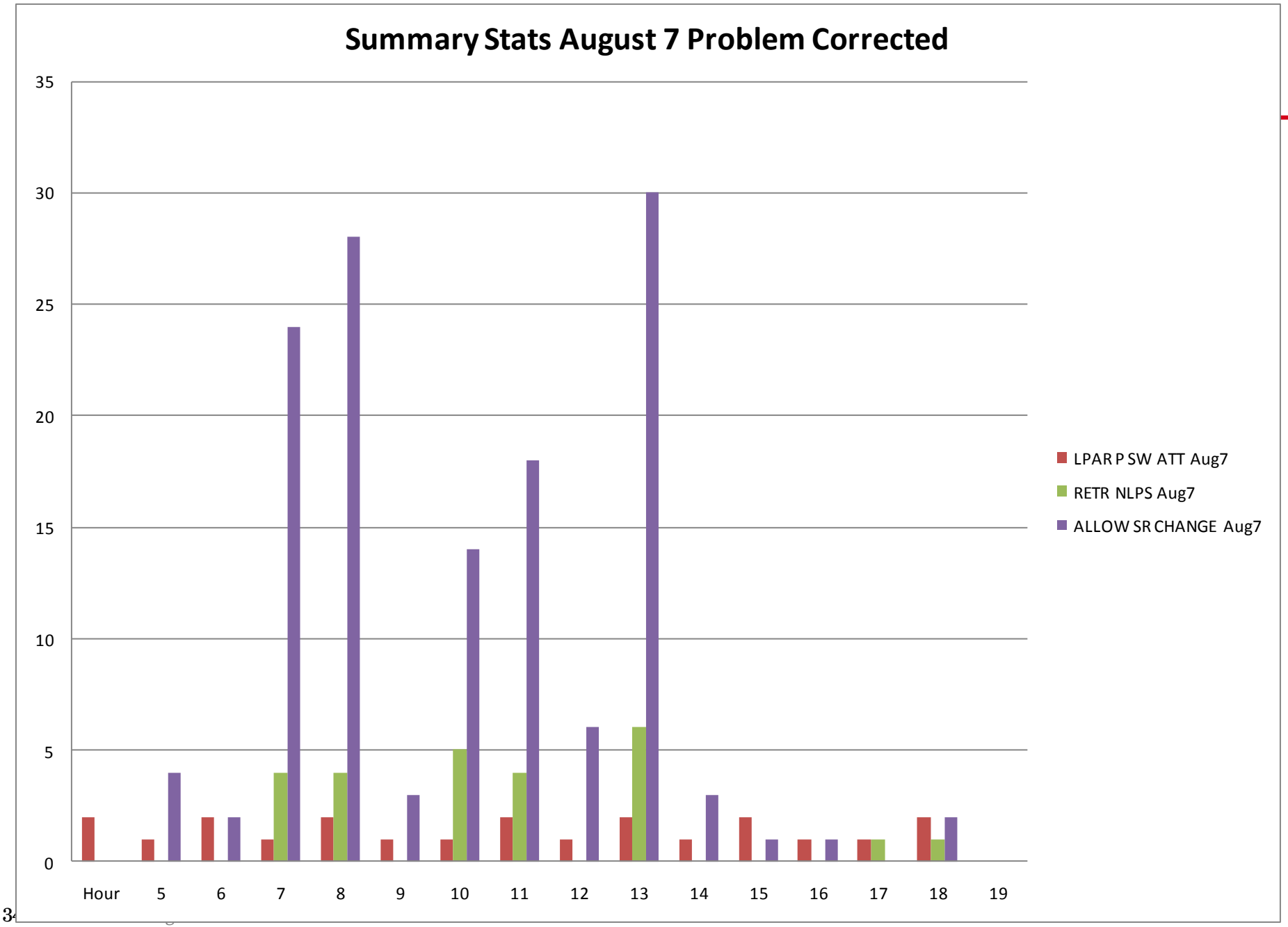
SYSE Yellow 2500-3000 SYS2 Lt Green, SYS3 Brown, SYS4 Blue, SYS5 Green

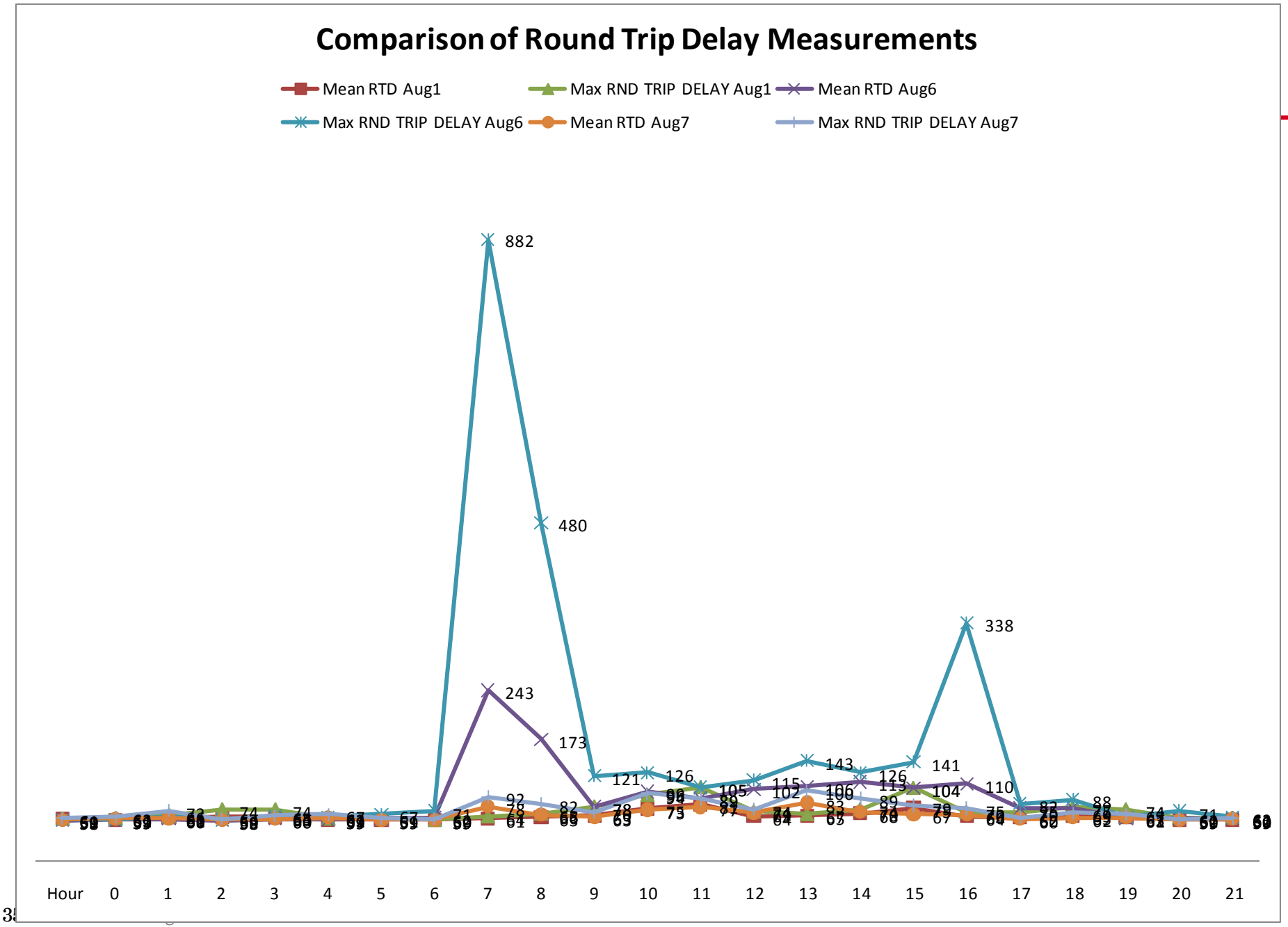


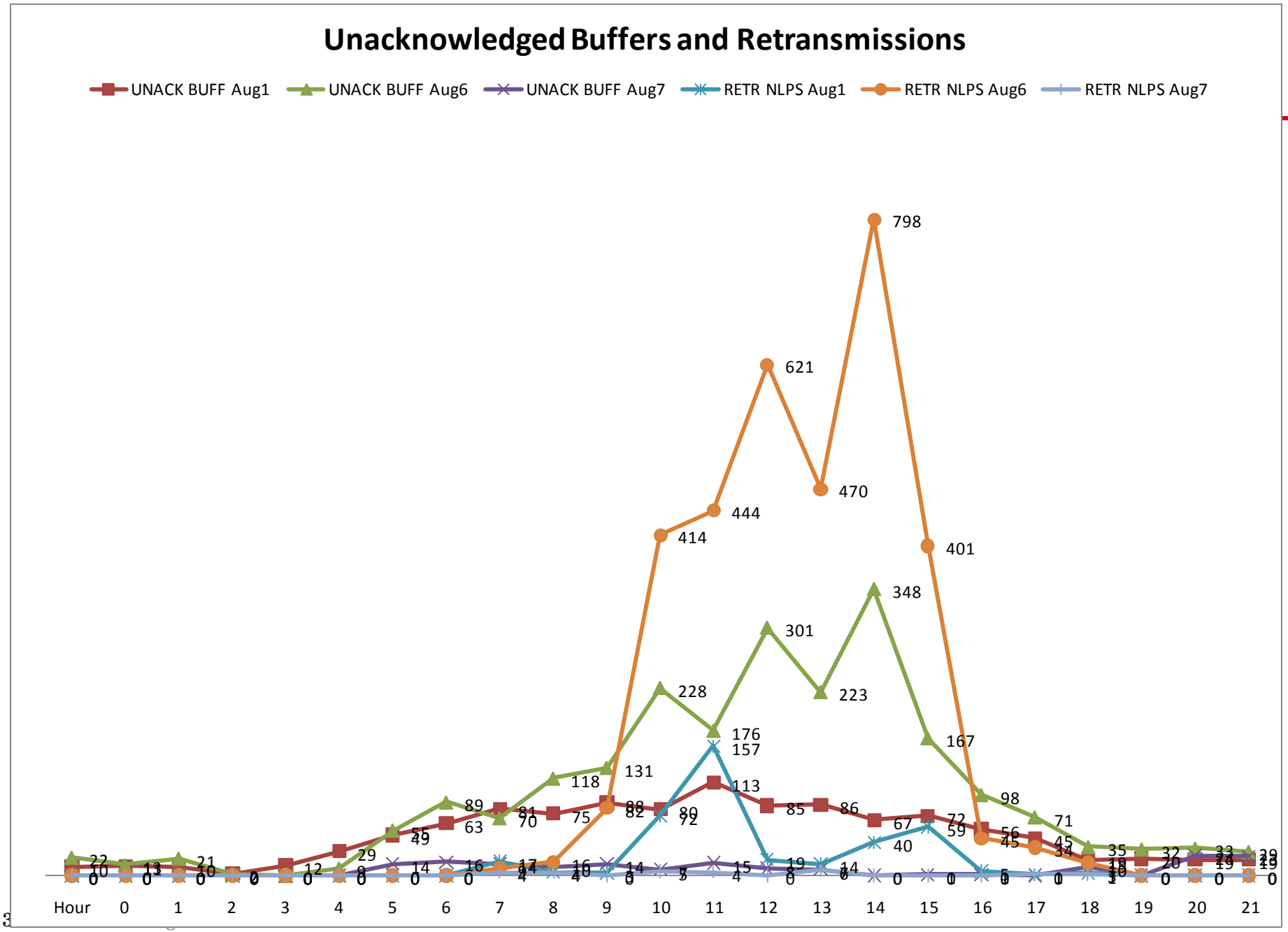

August 1 Stats No "Reported" Problem
LPAR P SW ATT Aug1
RETR NLPS Aug1
ALLOW SR CHANGE Aug1
Hour
6
7
8
9
10
11
12
13
14
15
16
17
18
3 0 40
2 0 98
4 17 395
2 4 254
4 3 349
2 72 472
3 157 899
3 19 444
4 14 332
2 40 429
4 59 461
2 5 155
2 1 96
4 3 78

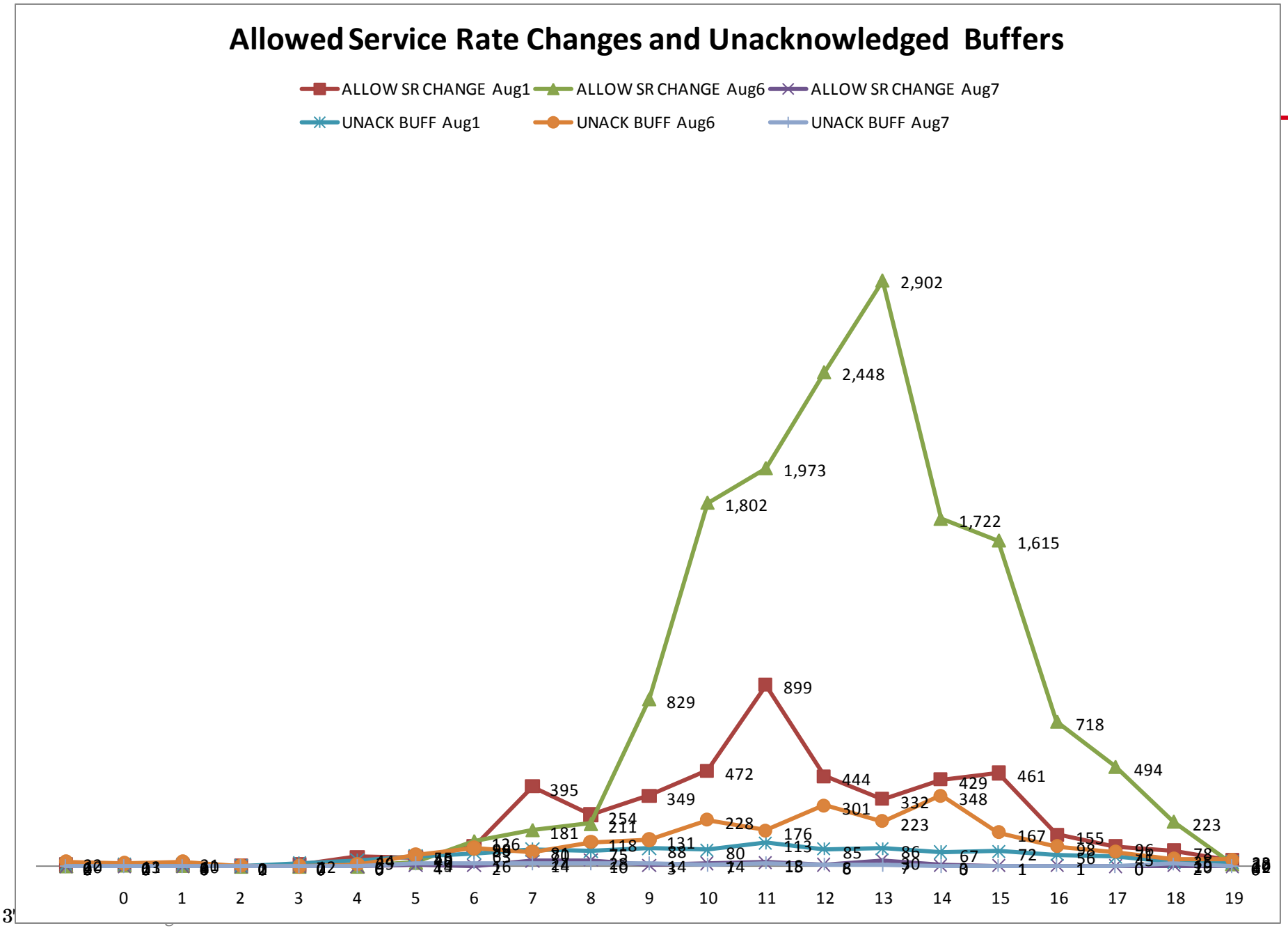

August 6th Data - Problem Reported
3500
3000
2500
2000
1500
1000
500
0
Hour
8
9
10
11
12
13
14
15
16
LPAR P SW ATT
RETR NLPS
ALLOW SR CHANGE

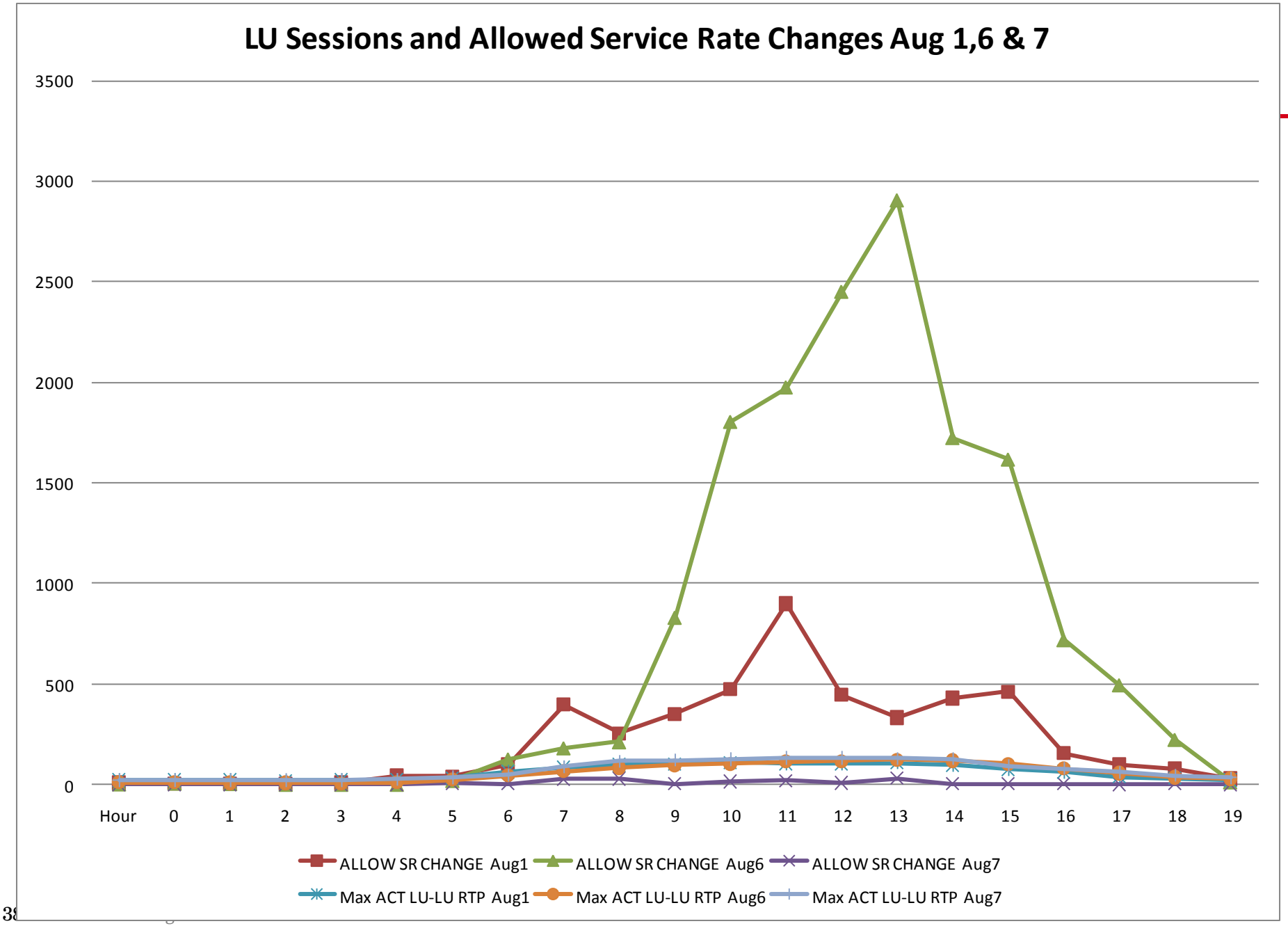

August 1 Stats No Reported Problem
LPAR P SW ATT Aug1
RETR NLPS Aug1
ALLOW SR CHANGE Aug1
Hour
6
7
8
9
10
11
12
13
14
15
16
17
18
3 0 40
2 0 98
4 17 395
2 4 254
4 3 349
2 72 472
3 157 899
3 19 444
4 14 332
2 40 429
4 59 461
2 5 155
2 1 96
4 3 78

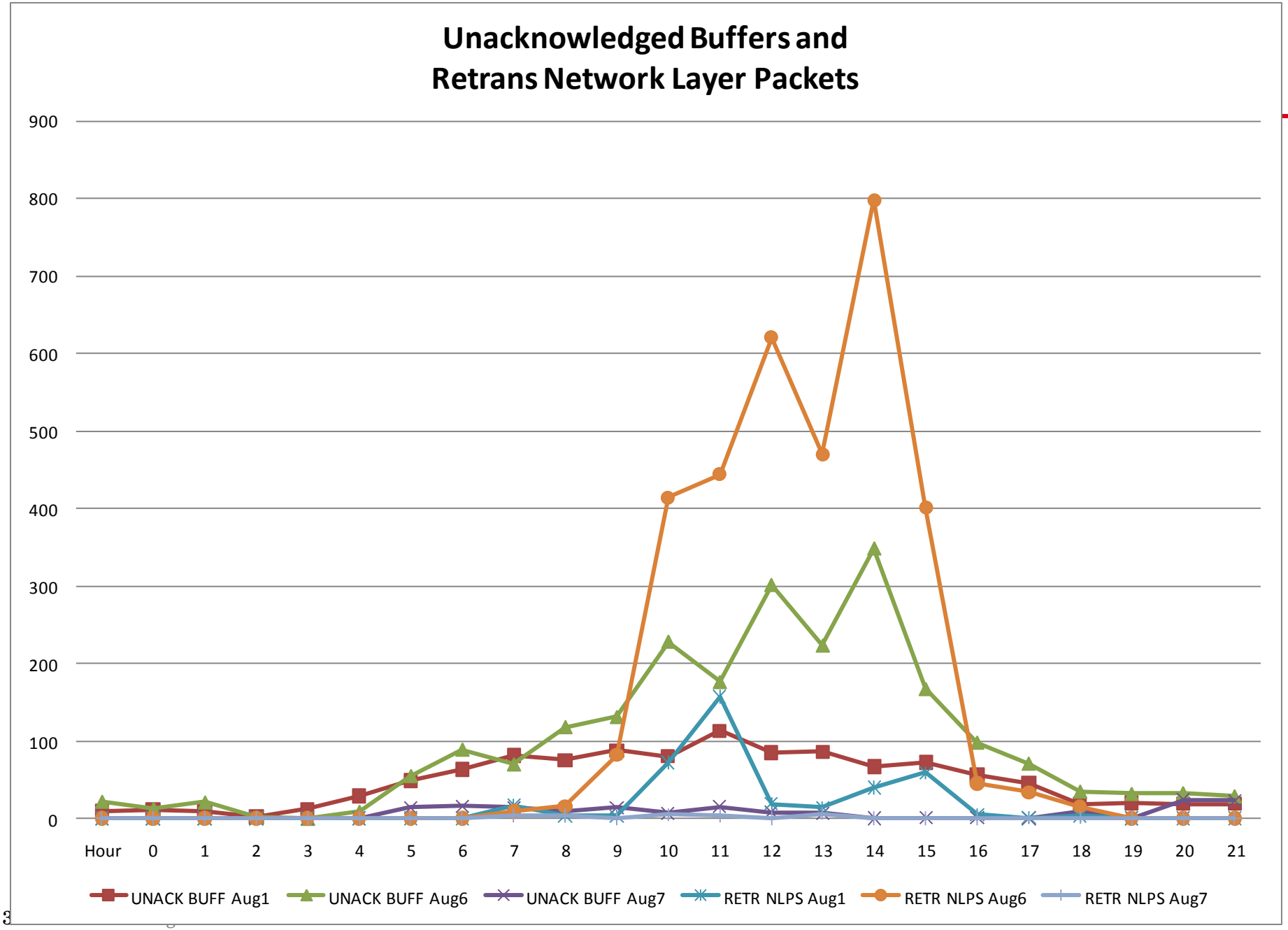

Summary Stats August 7 Problem Corrected
35
30
25
20
15
10
5
0
Hour
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
LPAR P SW ATT Aug7
RETR NLPS Aug7
ALLOW SR CHANGE Aug7

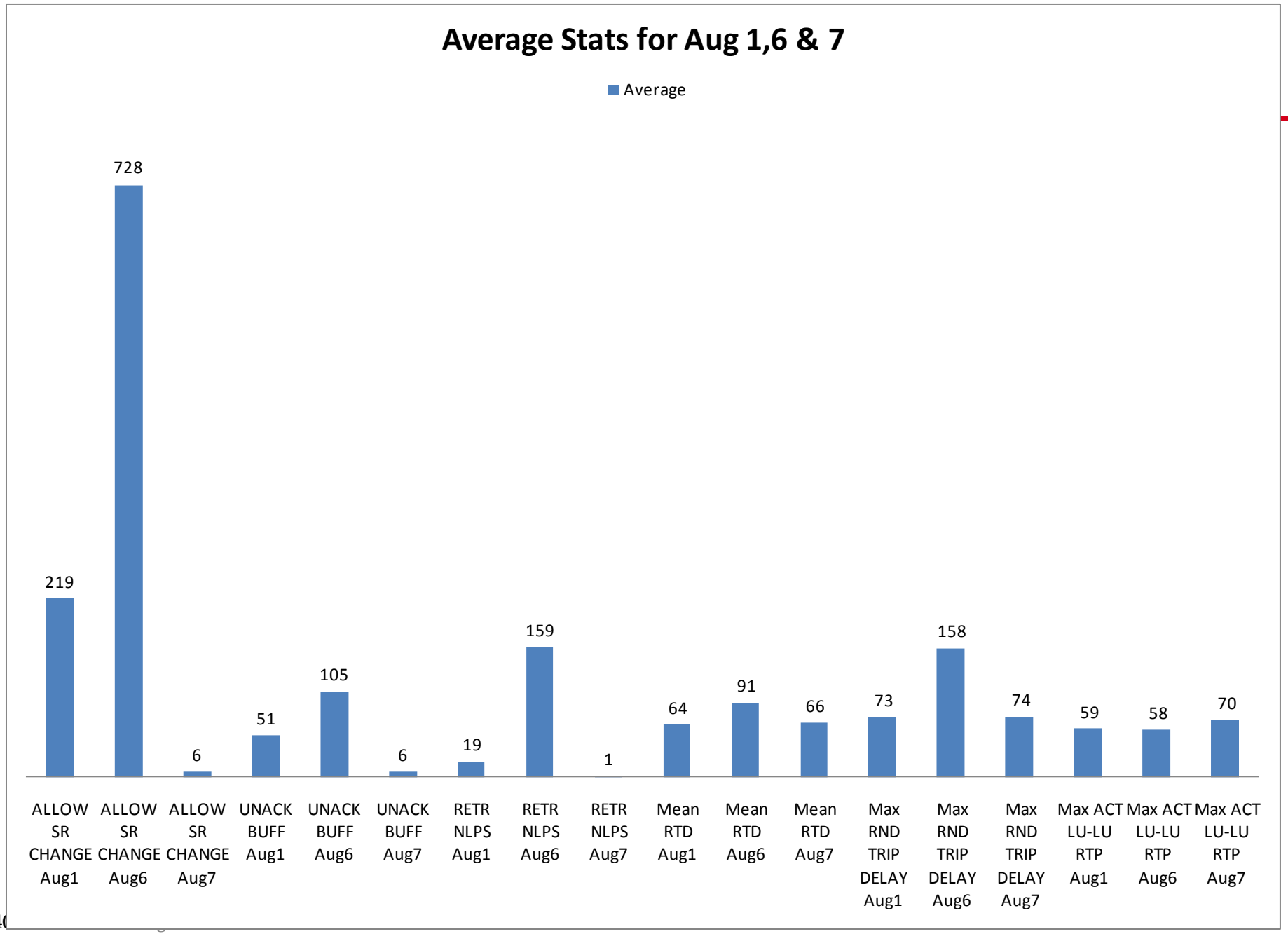

Comparison of Round Trip Delay Measurements
Mean RTD Aug1
Max RND TRIP DELAY Aug1
Mean RTD Aug6
Max RND TRIP DELAY Aug6
Mean RTD Aug7
Max RND TRIP DELAY Aug7
882
480
338
243
173
143
141
126
121
115
110
104
Hour
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21


Unacknowledged Buffers and Retransmissions
UNACK BUFF Aug1
UNACK BUFF Aug6
UNACK BUFF Aug7
RETR NLPS Aug1
RETR NLPS Aug6
RETR NLPS Aug7
Hour
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
798
621
470
444
414
401
348
301
223
228
176
167
157
131
118
113
98
89
86
85
81
80
75
72
71
70
67
63
59
56
55
49
45
40
35
32
29
22
21
20
19
16
14
12
10


Allowed Service Rate Changes and Unacknowledged Buffers
ALLOW SR CHANGE Aug1
ALLOW SR CHANGE Aug6
ALLOW SR CHANGE Aug7
UNACK BUFF Aug1
UNACK BUFF Aug6
UNACK BUFF Aug7
2,902
2,448
1,973
1,802
1,722
1,615
899
829
718
494
472
461
444
429
395
349
348
332
301
254
228
223
211
181
176
167
155
131
118
113
88
86
85
80
72
67
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19


LU Sessions and Allowed Service Rate Changes Aug 1,6 & 7
3500
3000
2500
2000
1500
1000
500
0
Hour
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
ALLOW SR CHANGE Aug1
ALLOW SR CHANGE Aug6
ALLOW SR CHANGE Aug7
Max ACT LU-LU RTP Aug1
Max ACT LU-LU RTP Aug6
Max ACT LU-LU RTP Aug7


Unacknowledged Buffers and
Retrans Network Layer Packets
900
800
700
600
500
400
300
200
100
0
Hour 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
UNACK BUFF Aug1
UNACK BUFF Aug6
UNACK BUFF Aug7
RETR NLPS Aug1
RETR NLPS Aug6
RETR NLPS Aug7

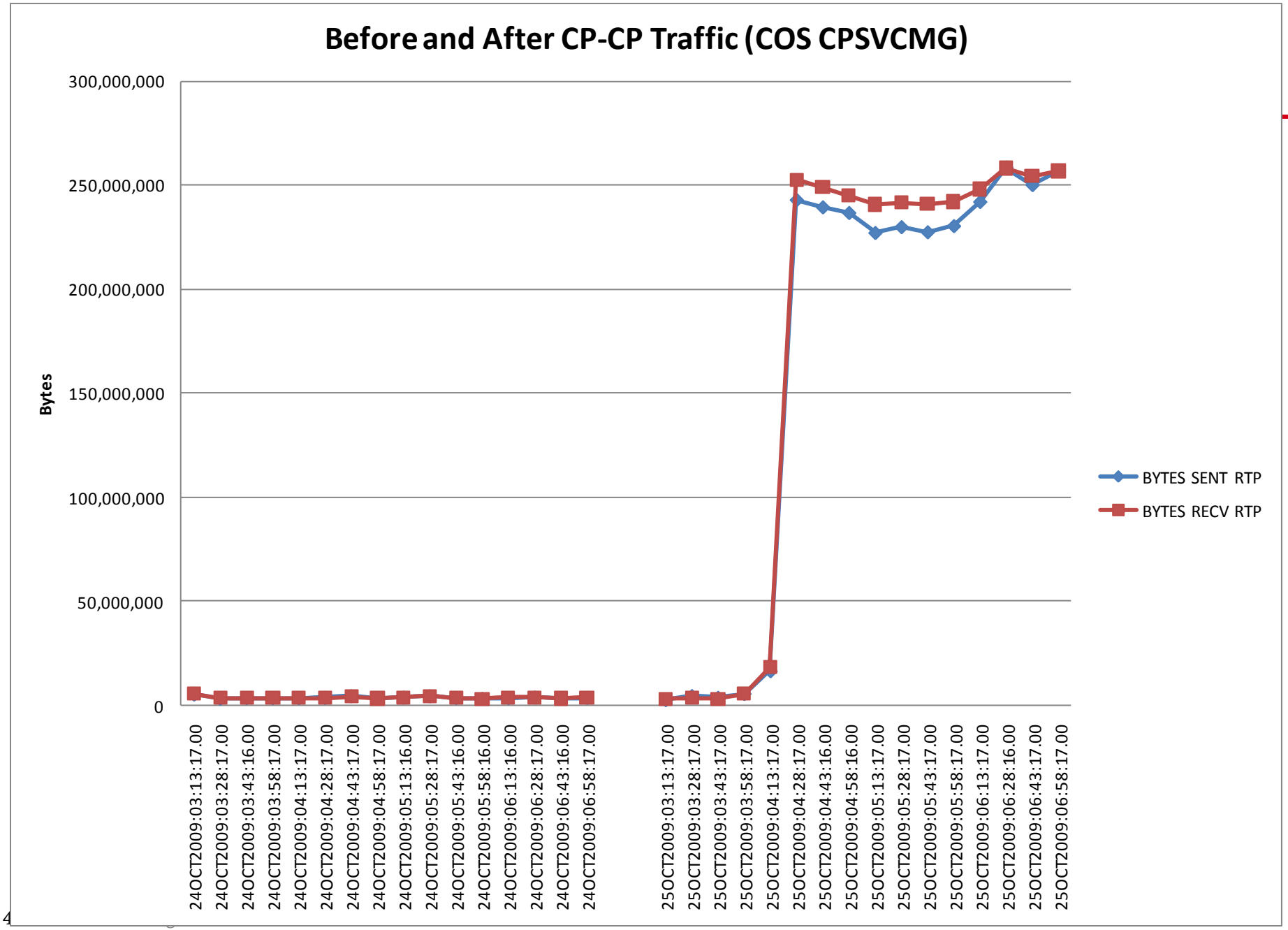

Average Stats for Aug 1,6 & 7
Average
219
728
6
51
105
6
19
159
1
64
91
66
73
158
74
59
58
70
ALLOW SR CHANGE Aug1
ALLOW SR CHANGE Aug6
ALLOW SR CHANGE Aug7
UNACK BUFF Aug1
UNACK BUFF Aug6
UNACK BUFF Aug7
RETR NLPS Aug1
RETR NLPS Aug6
RETR NLPS Aug7
Mean RTD Aug1
Mean RTD Aug6
Mean RTD Aug7
Max RND TRIP DELAY Aug1
Max RND TRIP DELAY Aug6
Max RND TRIP DELAY Aug7
Max ACT LU-LU RTP Aug1
Max ACT LU-LU RTP Aug6
Max ACT LU-LU RTP Aug7

"TDU WAR" Excessive Topology Updates Between NNs

- Symptoms
  - High CPU on Network Nodes
  - Followed by storage expansions and SVC abends on NN VTAMs
  - Sessions began to fail.
- Symptoms relieved by shutting down selected EE links.
- Lengthy Triage effort with BAC and IBM SMEs
  - SMF provided one of the inputs and was most helpful in identifying when the "WAR" began.
- General methodology
  - See if High CPU is associated with Hi Volume
  - Did not find high volume but did find an increase in "Overhead" traffic.
  - Drilled down to determine pertinent measurements.

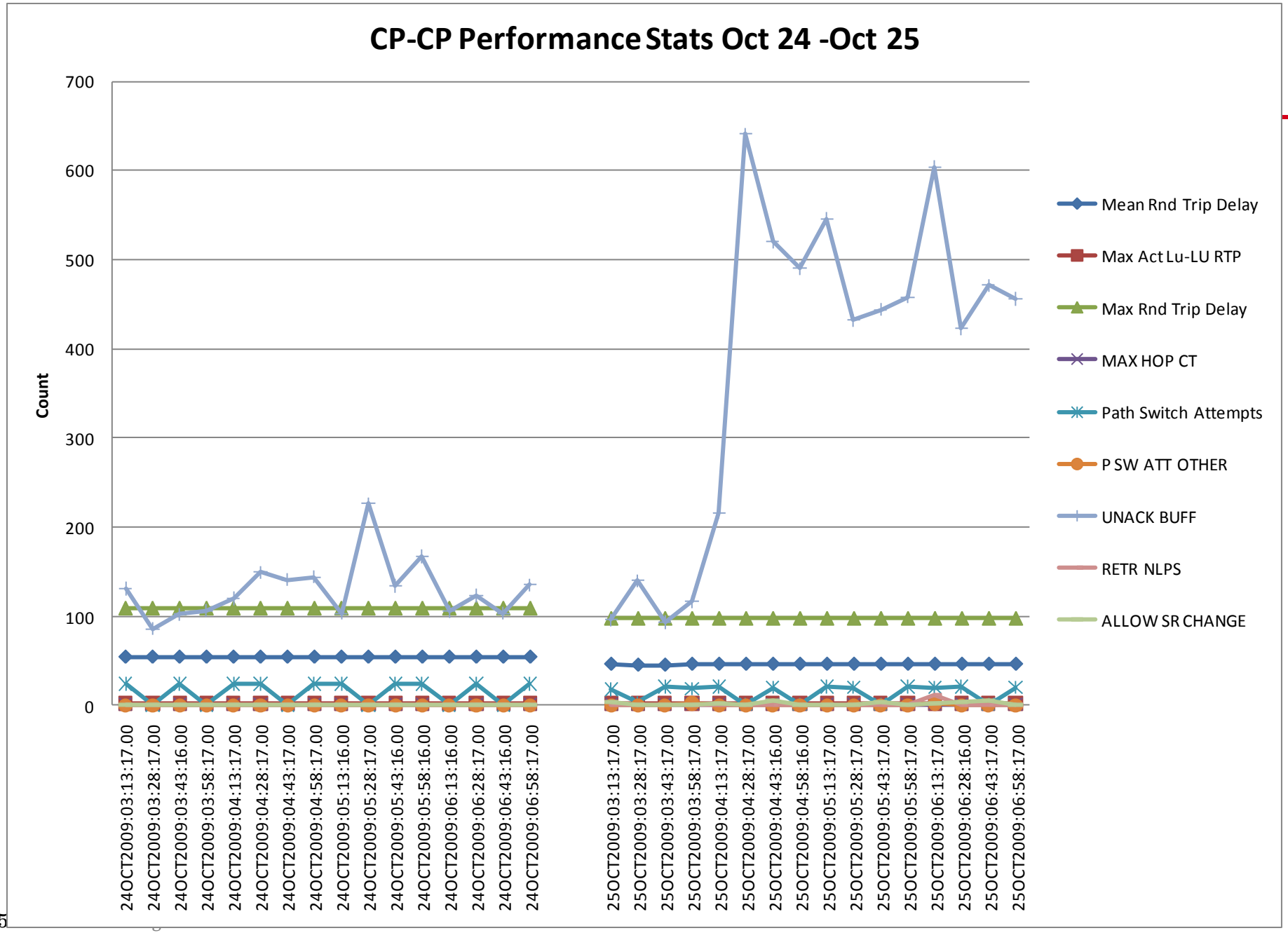
- IBM developed a solution to prevent future occurrences.

LPAR0E CPSVCMG Traffic Collection Date Time	Mean Rnd Trip Delay	Max Act Lu-LU RTP	Max Rnd Trip Delay	MAX HOP CT	Path Switch Attempts	P SW ATT OTHER	UNAC K BUFF	RETR NLPS	ALLOW SR CHANGE	BYTES SENT RTP	BYTES RECV RTP
24OCT2009:03:13:17.0	54	2	109	1	24	0	131	0	0	5,111,858	5,441,777
24OCT2009:03:28:17.0	54	2	109	1	0	0	86	0	0	3,041,608	3,291,096
24OCT2009:03:43:16.0	54	2	109	1	24	0	102	0	0	3,390,245	3,423,894
24OCT2009:03:58:17.0	54	2	109	1	0	0	106	0	0	3,408,109	3,412,892
24OCT2009:04:13:17.0	54	2	109	1	24	0	120	0	0	3,357,620	3,352,570
24OCT2009:04:28:17.0	54	2	109	1	24	0	149	0	0	3,485,531	3,317,208
24OCT2009:04:43:17.0	54	2	109	1	0	0	141	0	0	4,275,923	3,931,452
24OCT2009:04:58:17.0	54	2	109	1	24	0	144	0	0	3,224,427	3,163,967
24OCT2009:05:13:16.0	54	2	109	1	24	0	103	0	1	3,598,307	3,599,446
24OCT2009:05:28:17.0	54	2	109	1	0	0	226	0	0	4,225,731	4,299,402
24OCT2009:05:43:16.0	54	2	109	1	24	0	134	0	0	3,437,069	3,398,770
24OCT2009:05:58:16.0	54	2	109	1	24	0	167	0	1	3,012,831	2,974,396
24OCT2009:06:13:16.0	54	2	109	1	0	0	105	0	1	3,377,820	3,510,563
24OCT2009:06:28:17.0	54	2	109	1	24	0	123	0	0	3,631,882	3,677,427
24OCT2009:06:43:16.0	54	2	109	1	0	0	103	0	0	3,245,098	3,256,358
24OCT2009:06:58:17.0	54	2	109	1	24	0	135	0	0	3,478,266	3,524,546
25OCT2009:03:13:17.0	46	2	98	1	18	0	96	1	3	2,430,435	2,972,161
25OCT2009:03:28:17.0	45	2	98	1	3	0	140	0	0	4,363,603	3,304,187
25OCT2009:03:43:17.0	45	2	98	1	21	0	93	0	0	3,546,055	2,885,358
25OCT2009:03:58:17.0	46	2	98	1	19	2	116	0	0	5,391,442	5,338,542
25OCT2009:04:13:17.0	46	2	98	1	21	0	216	0	2	16,334,937	18,127,547
25OCT2009:04:28:17.0	46	2	98	1	1	0	641	0	1	242,845,032	252,528,668
25OCT2009:04:43:16.0	46	2	98	1	20	0	520	0	5	239,314,120	249,017,970
25OCT2009:04:58:16.0	46	2	98	1	1	0	490	0	0	236,603,065	244,933,361
25OCT2009:05:13:17.0	46	2	98	1	21	0	546	0	1	226,989,125	240,751,521
25OCT2009:05:28:17.0	46	2	98	1	20	0	432	0	0	229,799,898	241,556,205
25OCT2009:05:43:17.0	46	2	98	1	1	0	444	0	3	227,330,821	240,834,005
25OCT2009:05:58:17.0	46	2	98	1	21	0	458	0	1	230,288,021	241,996,991
25OCT2009:06:13:17.0	46	2	98	1	20	2	604	11	2	241,910,565	247,974,380
25OCT2009:06:28:16.0	46	2	98	1	21	0	423	0	3	258,433,139	258,119,727
25OCT2009:06:43:17.0	46	2	98	1	1	0	471	0	5	250,012,556	254,372,276
25OCT2009:06:58:17.0	46	2	98	1	20	0	456	0	1	256,988,190	256,801,737


Before and After CP-CP Traffic (COS CPSVCMG)
Bytes
300,000,000
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
0
24OCT2009:03:13:17.00
24OCT2009:03:28:17.00
24OCT2009:03:43:16.00
24OCT2009:03:58:17.00
24OCT2009:04:13:17.00
24OCT2009:04:28:17.00
24OCT2009:04:43:17.00
24OCT2009:04:58:17.00
24OCT2009:05:13:16.00
24OCT2009:05:28:17.00
24OCT2009:05:43:16.00
24OCT2009:05:58:16.00
24OCT2009:06:13:16.00
24OCT2009:06:28:17.00
24OCT2009:06:43:16.00
24OCT2009:06:58:17.00
25OCT2009:03:13:17.00
25OCT2009:03:28:17.00
25OCT2009:03:43:17.00
25OCT2009:03:58:17.00
25OCT2009:04:13:17.00
25OCT2009:04:28:17.00
25OCT2009:04:43:16.00
25OCT2009:04:58:16.00
25OCT2009:05:13:17.00
25OCT2009:05:28:17.00
25OCT2009:05:43:17.00
25OCT2009:05:58:17.00
25OCT2009:06:13:17.00
25OCT2009:06:28:16.00
25OCT2009:06:43:17.00
25OCT2009:06:58:17.00
BYTES SENT RTP
BYTES RECV RTP

Performance Statistics

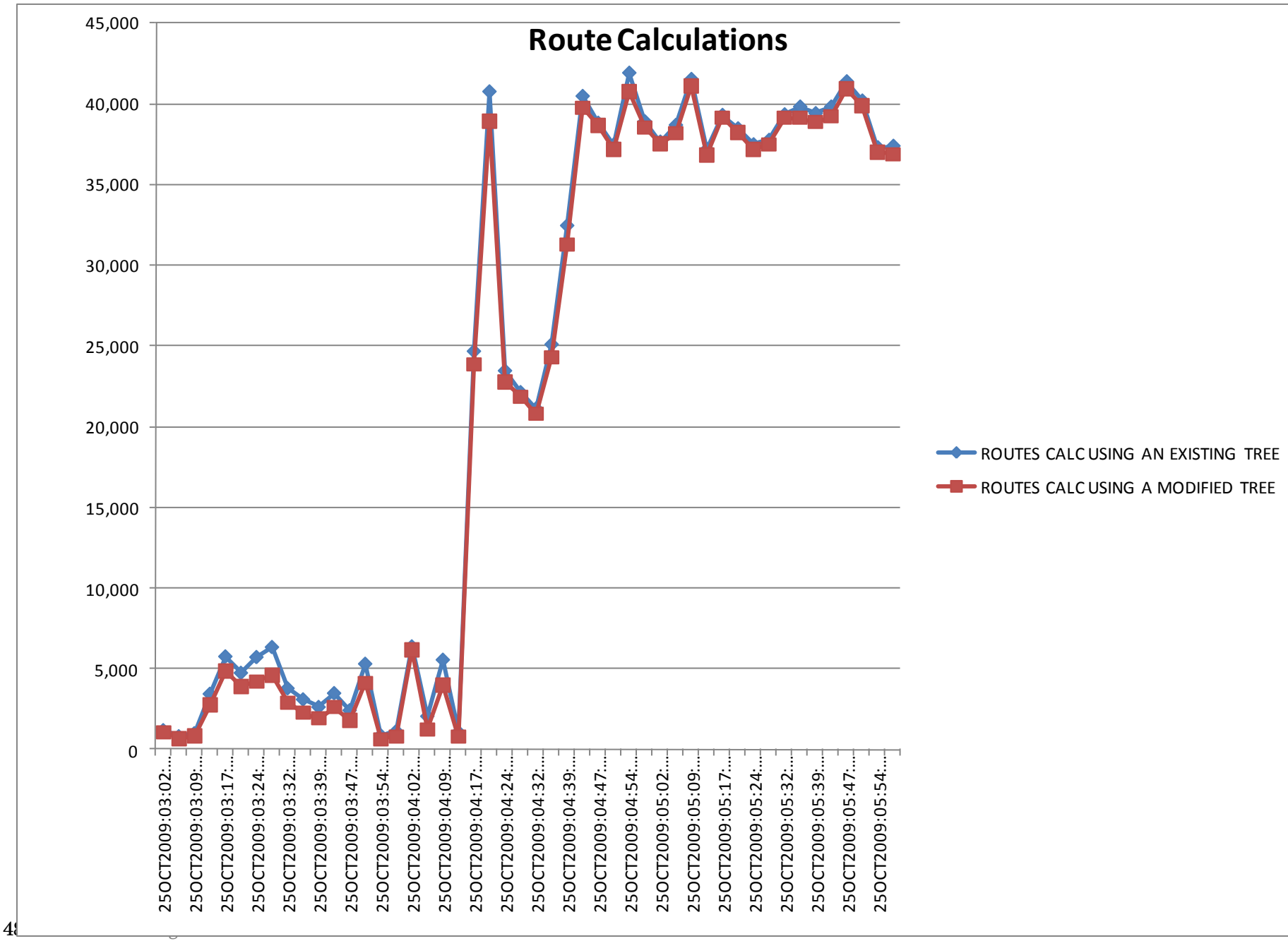
- Mean Round Trip Delay
- Max Count Lu-LU RTP
- Max Round Trip Delay
- Max HOP Count
- Path Switch Attempts
- Path Switch Attempts Other
- Unacknowledged Buffers
- Retransmitted Network Layer Packets
- Allowed Service Rate Changes
- Bytes Sent RTP
- Bytes Received RTP

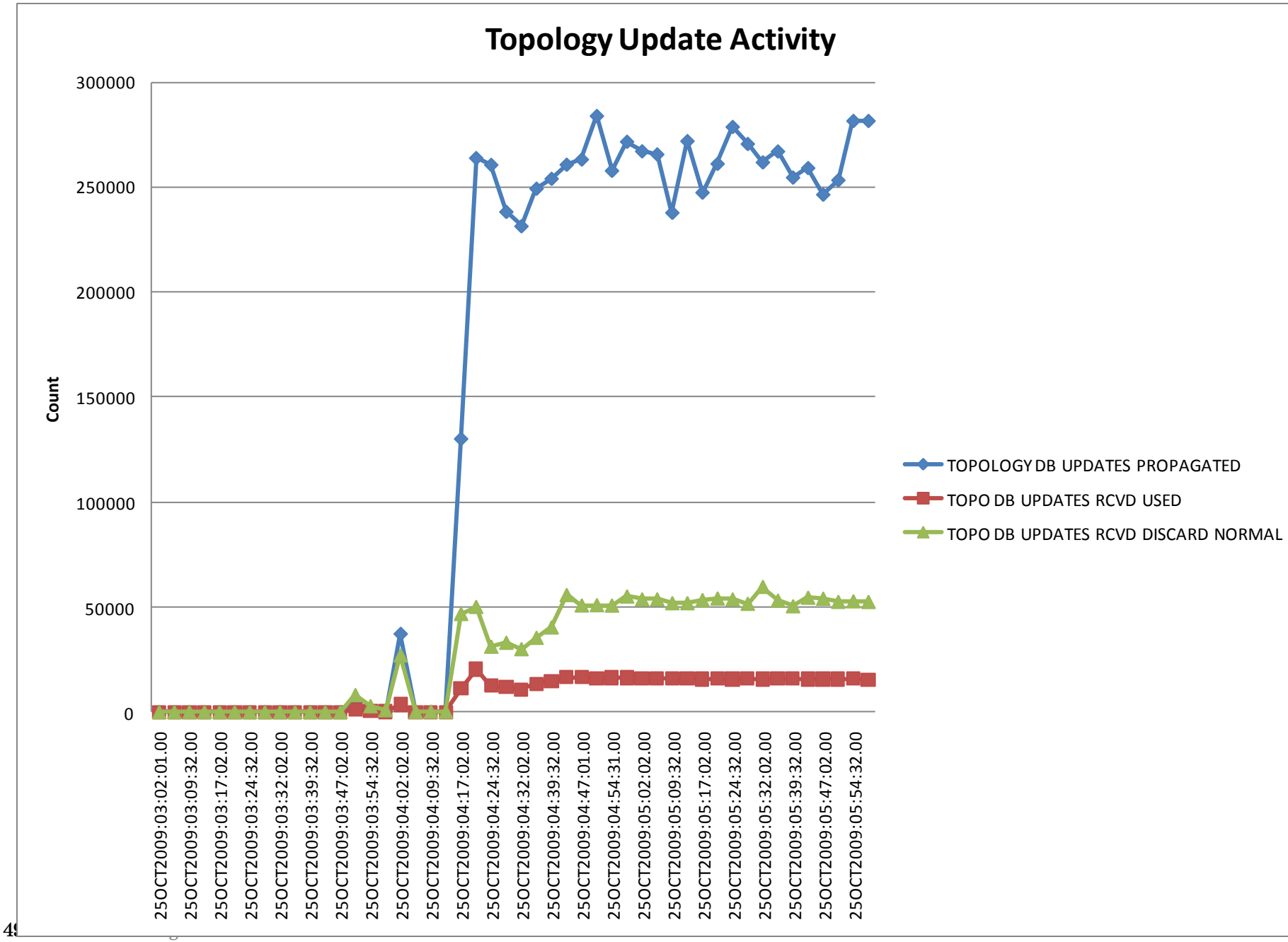

CP-CP Performance Stats Oct 24 -Oct 25
Count
700
600
500
400
300
200
100
0
24OCT2009:03:13:17.00
24OCT2009:03:28:17.00
24OCT2009:03:43:16.00
24OCT2009:03:58:17.00
24OCT2009:04:13:17.00
24OCT2009:04:28:17.00
24OCT2009:04:43:17.00
24OCT2009:04:58:17.00
24OCT2009:05:13:16.00
24OCT2009:05:28:17.00
24OCT2009:05:43:16.00
24OCT2009:05:58:16.00
24OCT2009:06:13:16.00
24OCT2009:06:28:17.00
24OCT2009:06:43:16.00
24OCT2009:06:58:17.00
25OCT2009:03:13:17.00
25OCT2009:03:28:17.00
25OCT2009:03:43:17.00
25OCT2009:03:58:17.00
25OCT2009:04:13:17.00
25OCT2009:04:28:17.00
25OCT2009:04:43:16.00
25OCT2009:04:58:16.00
25OCT2009:05:13:17.00
25OCT2009:05:28:17.00
25OCT2009:05:43:17.00
25OCT2009:05:58:17.00
25OCT2009:06:13:17.00
25OCT2009:06:28:16.00
25OCT2009:06:43:17.00
25OCT2009:06:58:17.00
Mean Rnd Trip Delay
Max Act Lu-LU RTP
Max Rnd Trip Delay
MAX HOP CT
Path Switch Attempts
P SW ATT OTHER
UNACK BUFF
RETR NLPS
ALLOW SR CHANGE

Topology Data

- Routes via Existing Tree
- Routes via Modified Tree
- Topology DB Updates Originated
- Topology DB Updates Propagated
- Topology DB Updates Received

LPAROE (CMC1) 10/25/09 Collect Time	Routes via Existing Tree	Routes via Modified Tree	Topology DB Updates Originated	Topology DB Updates Propagated	Tope DB Updates Received
25Oct2009 :03:47:02.00	2,424	1,800	0	0	0
25Oct2009:03:50:47.00	5,305	4,115	4	4,291	1,106
25Oct2009:03:54:32.00	873	622	0	960	398
25Oct2009:03:58:17.00	1,138	799	0	238	114
25Oct2009:04:02:02.00	6,381	6,146	0	37,228	3,538
25Oct2009:04:05:47.00	2,059	1,246	0	57	11
25Oct2009:04:09:32.00	5,555	3,971	0	32	36
25Oct2009:04:13:17.00	1,083	786	0	53	30
25Oct2009:04:17:02.00	24,677	23,863	0	130,143	11,142
25Oct2009:04:20:47.00	40,769	38,939	0	263,944	20,468
25Oct2009:04:24:32.00	23,468	22,772	0	260,689	12,536
25Oct2009:04:28:17.00	22,136	21,862	0	238,297	11,844
25Oct2009:04:32:02.00	21,128	20,767	0	231,447	10,776
25Oct2009:04:35:47.00	25,103	24,301	0	249,356	13,392
25Oct2009:04:39:32.00	32,464	31,303	0	254,068	14,794
25Oct2009:04:43:16.00	40,485	39,774	0	260,783	16,541
25Oct2009:04:47:01.00	38,826	38,663	0	263,258	16,523
25Oct2009:04:50:46.00	37,482	37,170	0	283,988	16,180
25Oct2009:04:54:31.00	41,927	40,761	0	257,873	16,323


Route Calculations
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
25OCT2009:03:02:...
25OCT2009:03:09:...
25OCT2009:03:17:...
25OCT2009:03:24:...
25OCT2009:03:32:...
25OCT2009:03:39:...
25OCT2009:03:47:...
25OCT2009:03:54:...
25OCT2009:04:02:...
25OCT2009:04:09:...
25OCT2009:04:17:...
25OCT2009:04:24:...
25OCT2009:04:32:...
25OCT2009:04:39:...
25OCT2009:04:47:...
25OCT2009:04:54:...
25OCT2009:05:02:...
25OCT2009:05:09:...
25OCT2009:05:17:...
25OCT2009:05:24:...
25OCT2009:05:32:...
25OCT2009:05:39:...
25OCT2009:05:47:...
25OCT2009:05:54:...
ROUTES CALC USING AN EXISTING TREE
ROUTES CALC USING A MODIFIED TREE


Topology Update Activity
Count
300000
250000
200000
150000
100000
50000
0
25OCT2009:03:02:01.00
25OCT2009:03:09:32.00
25OCT2009:03:17:02.00
25OCT2009:03:24:32.00
25OCT2009:03:32:02.00
25OCT2009:03:39:32.00
25OCT2009:03:47:02.00
25OCT2009:03:54:32.00
25OCT2009:04:02:02.00
25OCT2009:04:09:32.00
25OCT2009:04:17:02.00
25OCT2009:04:24:32.00
25OCT2009:04:32:02.00
25OCT2009:04:39:32.00
25OCT2009:04:47:01.00
25OCT2009:04:54:31.00
25OCT2009:05:02:02.00
25OCT2009:05:09:32.00
25OCT2009:05:17:02.00
25OCT2009:05:24:32.00
25OCT2009:05:32:02.00
25OCT2009:05:39:32.00
25OCT2009:05:47:02.00
25OCT2009:05:54:32.00
TOPOLOGY DB UPDATES PROPAGATED
TOPO DB UPDATES RCVD USED
TOPO DB UPDATES RCVD DISCARD NORMAL

Summary

- Reports based on SMF Data play a critical role for managing APPN/HPR traffic.
- Reports are sourced from both Type 28 and Type 39 Records
- As always trick is to determine meaningful statistics
- Our process
  - Develop a Baseline via comprehensive reports
  - Monitor exceptions
  - Continue to refine
- Questions?

APPN COS Definitions

- #BATCH An APPN CoS for LU-LU sessions that specifies a general batch-oriented CoS that uses low transmission priority, and for which high bandwidth and low cost are considered more important than short delay.
- #BATCHSC An APPN CoS for LU-LU sessions that specifies a general batch-oriented CoS that uses low transmission priority, and for which high bandwidth and low cost are considered more important than short delay. A minimum security level is required.
- #CONNECT An APPN CoS for LU-LU sessions that provides connectivity at medium transmission priority.
- #CONNECT should not be changed.
- CPSVCMG An APPN CoS for CP-CP sessions that is used for network flows. It provides connectivity at network transmission priority.
- CPSVCMG should not be changed.
- #INTER An APPN CoS for LU-LU sessions that specifies a general, interactive Class of Service that uses high transmission priority, and for which short delay is considered more important than high bandwidth and lost cost.
- #INTERSC An APPN CoS for a LU-LU session that specifies a general, interactive CoS that uses high transmission priority, and for which short delay is considered more important than high bandwidth and lost cost. A minimal security level is required.
- SNASVCMG An APPN CoS for LU-LU CNOS sessions that provides connectivity at network transmission priority.
- SNASVCMG should not be changed.