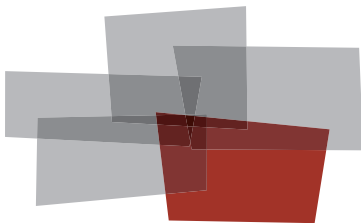**InfoPlus**

Traffic Study
with IP Trunking Analysis
"How well is my Communication Server performing?"

Produced For

Nortel CS1000 Demo

Customer Number: **1234567890**
Reflecting information from: **1/4/2018 - 1/10/2018**

Inventory
Configuration
Performance
Security
Backup

Communications Management with InfoPlus

Regardless of the size or type of organization, there are a few basic concerns of every communications manager. InfoPlus services help address those various concerns through an integrated suite of reports and analyses.

Inventory
Configuration
Performance
Security
Backup

Performance – The InfoPlus Traffic Study consists of analyses and recommendations that address the dynamic aspects of a communications system. Presented as a consultative report (as opposed to a "data dump") the Traffic Study addresses system resources, networks, trunks, processors and even operator consoles. Internal blockages and excessive costly outside facilities are identified and recommendations are made to reduce costs and improve service. Annual Traffic Studies are an important ingredient to consistent high quality and cost effective communications.

While the InfoPlus Traffic Study will improve the cost effectiveness of your communications, you may recognize the need for additional system information, answering questions such as, "Which of my three T-1's really is Trunk Group 3?" The InfoPlus SourceBook defines all the system programming that makes your communications system uniquely yours. Graphics depicting each set, identification of each software group (Call Pick-up, Intercom, etc.), Trunk Groups, call routing and even service improving Action Items are assembled uniquely for your system.

Other services in the InfoPlus suite include:

Inventory – InfoPlus Site Survey
- Inventory of the major Communication Server hardware and software components
- "End-of-Life" analysis pinpoints unsupported equipment
- Access to database for enterprise customers

Configuration – InfoPlus SourceBook
- Details a Communication Server's programming
- Graphics of each set and each button's feature or line assignment
- Lists of each defined group (Intercom, Call Pick-up, etc.)
- Clearly defines Trunking, Call Routing, and even Calling Privileges
- Service-improving Action Items are uniquely determined for your system

Security – InfoPlus Security Audit
- Detailed, computerized review of the system's programming
- Analyses of 83 separate features with security implications
- Each analysis consists of a feature description, the security concerns and recommended changes in programming
- One hour of personal consultation is included

Backup – InfoPlus Backup Service
- Off-site backup of your Communication Server's configuration
- Available at any time for restoration through the Internet

Please contact your telecommunications vendor for additional information about these services.

Table of Contents

Introduction

We are pleased to provide you with the following Traffic Study to help you identify and address areas of concern involved with the performance of your telecommunications system.

A Traffic Study can be broken down into three general categories. There are several reports on switch performance, measuring among other things the balancing of traffic among available resources, the sufficiency of common resources such as Tone Generators, and even the processor itself. Generally, these are engineering issues and not directly related to either costs or the quality of service during normal conditions. However, addressing any issues raised will ensure proper service as the business continues to evolve. A second part of the study, the Trunking section, addresses both costs and service. Too few trunks and service to either internal or outside callers suffers, too many trunks and you are paying far more in monthly telephone company charges than is necessary. The last category addresses issues of Operator activity and performance with objective data.

Each section has its own introduction explaining exactly what it is that is being measured and how to interpret the results. Occasionally we found it necessary to use some jargon, however, at the end of the report is a glossary of terms for your reference.

Just as we bring our cars in for periodic servicing, an annual Traffic Study is a prudent step in ensuring cost-effective and reliable communications.

Study Methodology

The Avaya Meridian/Succession Communication Server comes equipped with registers specifically provided to collect traffic data. This data, if accumulated over a period of time, is the most meaningful information which can be analyzed to help determine the performance of the switch, the sufficiency of the Trunk Groups connected to the switch, and the work load of the consoles. Once each hour during the study period, a call was made to the Communication Server to extract traffic data reflecting activity experienced during the previous hour. This data has been accumulated during the study period and processed after to yield the following report.

The data for this Traffic Study was collected over the following period:

Data Collection Dates: 1/4/2018 - 1/10/2018
Number of Days in Study: 7
Beginning Hour: 12AM
Hours Per Day: 24

Collected Data

The following table shows the days and hours of traffic data which were collected for the production of this Traffic Study. Depending on the configuration of the study, there may be no data collected during Saturday and/or Sunday. Due to technical difficulties or inaccessibility to the Communication Server, some individual hours of information may have been unobtainable. A bullet (•) indicates all data was retrieved successfully from the Communication Server for that hour, while an upper-case letter indicates missed data. (see the legend below) Up to five attempts are made during the hour to retrieve the traffic data from the Communication Server, and the last trouble encountered is reported.

Captured Data Legend	
• - All Data Captured	
A - Access Failure	D - Data Incomplete
B - Busy	O - Other Error
C - Communications Failure	- Not Called

Day	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Thu 1/4/18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Fri 1/5/18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sat 1/6/18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sun 1/7/18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mon 1/8/18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Tue 1/9/18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Wed 1/10/18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

1. Processor Occupancy

1.1. Procesor Occupancy

The information below provides an indication of the workload of the system, regardless of traffic. The processor is the engine which drives your Communication Server much like the engine in your car. And, just as the engine in your car has finite horsepower, the processor in your system also has finite power.

The manufacturer's formula (applied here) gives an indication of the amount of power used and the amount of power remaining. The formula specifies that 30% of the processor's capacity must be reserved for functions other than voice processing. Thus, the "Processor Utilization" measurements should not exceed 70%. In our calculation of Capacity Remaining, we use 70% as the maximum utilization allowed. Accordingly, the "Processor Utilization" and "Capacity Remaining" measurements, when added together, will total 70% rather than 100%.

Maximum Processor Utilization Sat 1/6/18 12AM-1AM

Processor Utilization: 3.5%
Capacity Remaining: 66.5%
Reserved For Communication Server: 30.0%
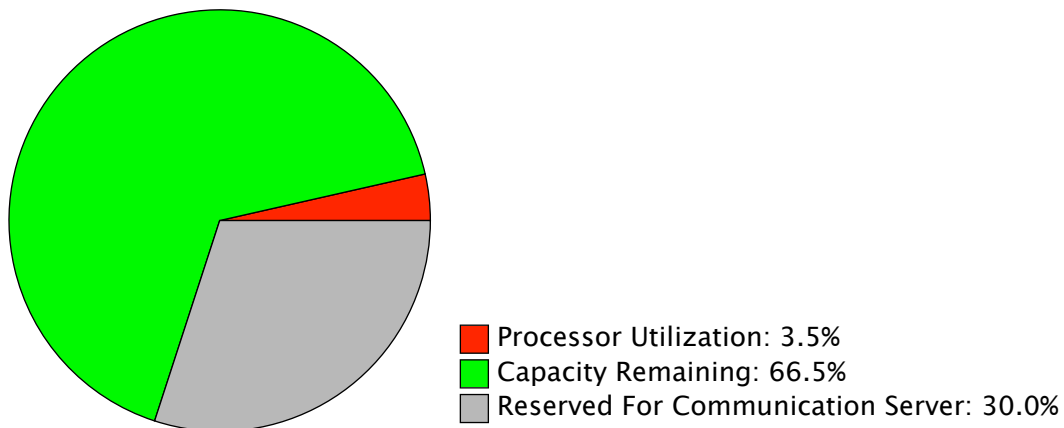
Average Processor Utilization

Processor Utilization: 2.8%
Capacity Remaining: 67.2%
Reserved For Communication Server: 30.0%
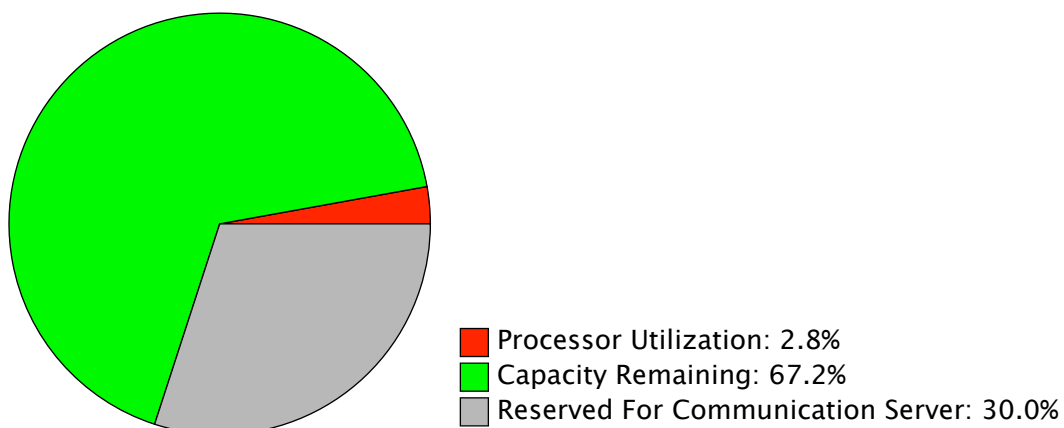
2. Networks

2.1. Bouncing Busy Hour Traffic

The following graph displays four separate sets of data. The columns represent the heaviest hourly volume of IntraLoop and InterLoop traffic (expressed in CCS) experienced during the study period. IntraLoop traffic is shown in light blue, while InterLoop traffic is shown in dark blue. The scale for the volume of traffic is given in CCS on the left hand side of the graph. For total traffic in any one hour, the two columns should be added together.

Similarly, the two line graphs display hourly peg count information for both IntraLoop and InterLoop connections. IntraLoop peg count information is shown by the yellow line while InterLoop peg count information is shown by the red line. The scale for the peg counts is on the right hand side of the graph, and they too may be added together to determine the total number of connection points within an hour.

Overall, this graph will allow you to identify your busiest hours of traffic, as it presents the busiest hour of traffic for each hourly period, regardless of which day of the study that traffic was generated.

Max Bouncing Busy Day
Nortel CS1000 Demo
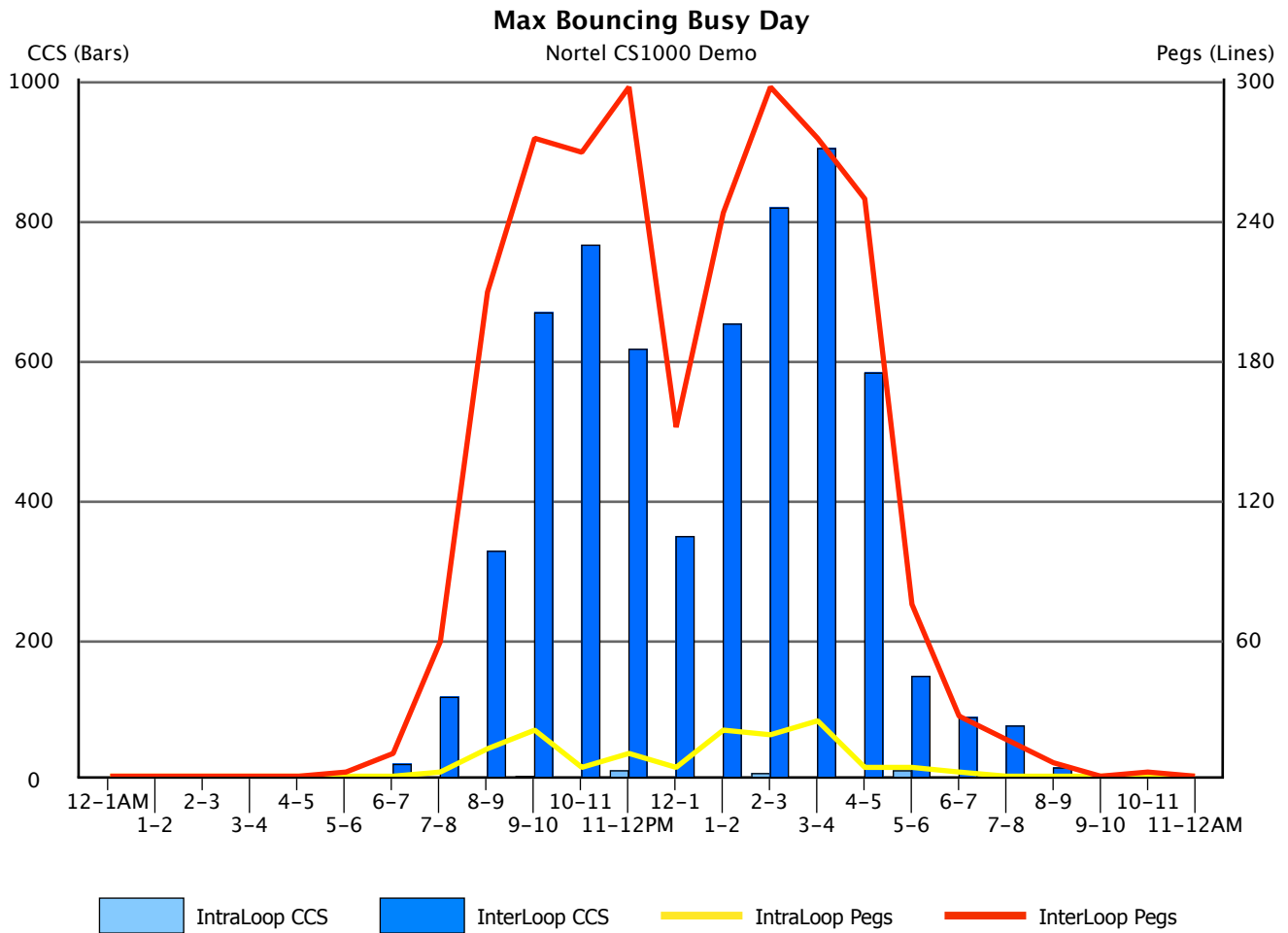
2.2. Average Hourly Traffic

If we were to take all of the terminal Loop traffic generated over the course of the study and obtain averages for each hour of the day, we would obtain the results below. Again, four sets of data are displayed using the same conventions as stated previously, i.e. columns represent volume of traffic using the scale on the left, with light blue reflecting IntraLoop traffic and dark blue reflecting InterLoop traffic; and lines represent peg counts using the scale on the right, with the yellow line reflecting IntraLoop pegs and the red line InterLoop pegs.

For total traffic in any one hour, the values of the two columns or lines should be added together.

A comparison between this graph and the one preceding will give an indication of "peakedness" of traffic, or the degree of change from the extremes (shown before) over the average, (shown here).

Average Hourly Traffic

Nortel CS1000 Demo
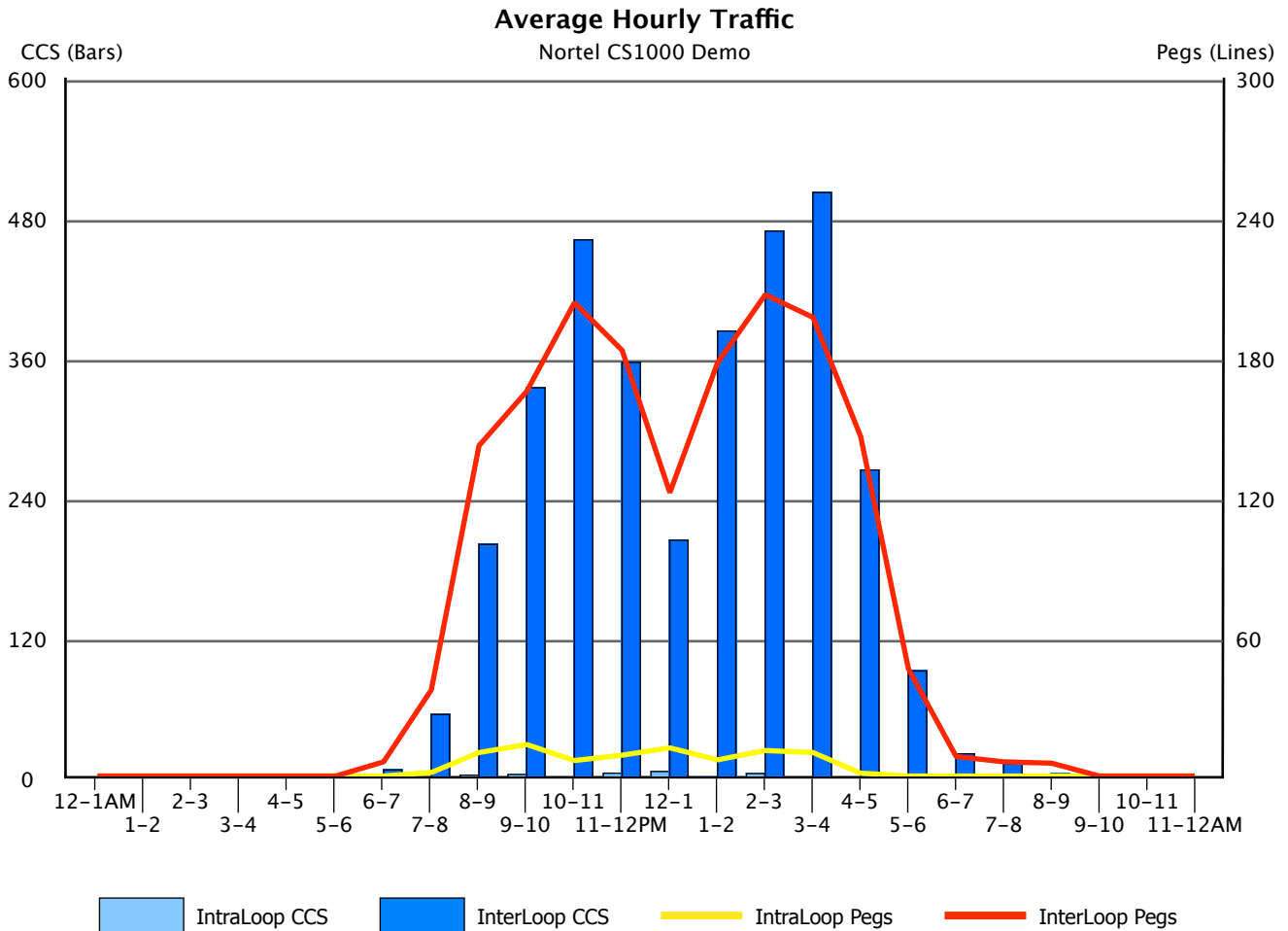
2.3. Bouncing Busy Hour Loop Traffic

Each port in your system is assigned to a Loop. Manufacturer recommendations state that Loops should be balanced such that they carry a relatively equal volume of traffic. The following graphs display the same four separate sets of data we have been working with, but this time it is organized by Loop. The columns represent the heaviest hourly volume of IntraLoop and InterLoop traffic (expressed as a percentage of recommended capacity) experienced during the study period, while the two line graphs display peg count information. For total traffic in any one hour, the values of the two columns or lines should be added together.

The percentage of recommended capacity, as opposed to CCS, was used to reflect traffic volumes in order to account for the varying traffic capacities of different Loop types. For example, a "Superloop" can carry 3,500 CCS of traffic with a P.01 grade of service, providing the same level of service that a conventional Loop provides carrying only 660 CCS. In order to make direct comparisons, a percentage of capacity was deemed appropriate.

Use the following graph(s) to determine which Loops, if any, should be "regraded" to more evenly distribute traffic, based strictly on volume. Ideally, no Loop should exceed 80% of recommended capacity and all Loops (excluding T–1's) should be within 14 percentage points of capacity of each other. Regrading entails reassigning ports to different Loops to remove traffic from one Loop while adding to another.

Superloops are noted with SUP, T–1's are noted with T–1, E–1's are noted with E–1, Remote loops are noted with REM, Conference loops are noted with CON, and Virtual loops are noted with VIR.

💡 Did You Know?

The InfoPlus SourceBook's 'Equipment List' section is an excellent source document to identify the ports assigned to each Loop and Network Group. Such information would be necessary before any re–grading can be performed.

Bouncing Busy Hour Traffic by Loop

% Cap (Bars)   Network Group 0   Pegs (Lines)

Legend: IntraLoop Traffic | InterLoop Traffic | IntraLoop Pegs | InterLoop Pegs

X-axis labels: 000 SUP, 004 SUP, 008 SUP, 012 SUP, 016 SUP, 020 T–1, 021 T–1, 022 T–1, 023 T–1, 029 CON, 030 CON, 031 CON

Bouncing Busy Hour Traffic by Loop

% Cap (Bars)   Network Group 1   Pegs (Lines)

X-axis labels: 032 SUP, 036 SUP, 040 SUP, 044 SUP, 048 SUP, 062 CON

| IntraLoop Traffic | InterLoop Traffic | IntraLoop Pegs | InterLoop Pegs |

Bouncing Busy Hour Traffic by Loop

% Cap (Bars)   Network Group 2   Pegs (Lines)

064	068	072	094	095
SUP	SUP	SUP	CON	CON
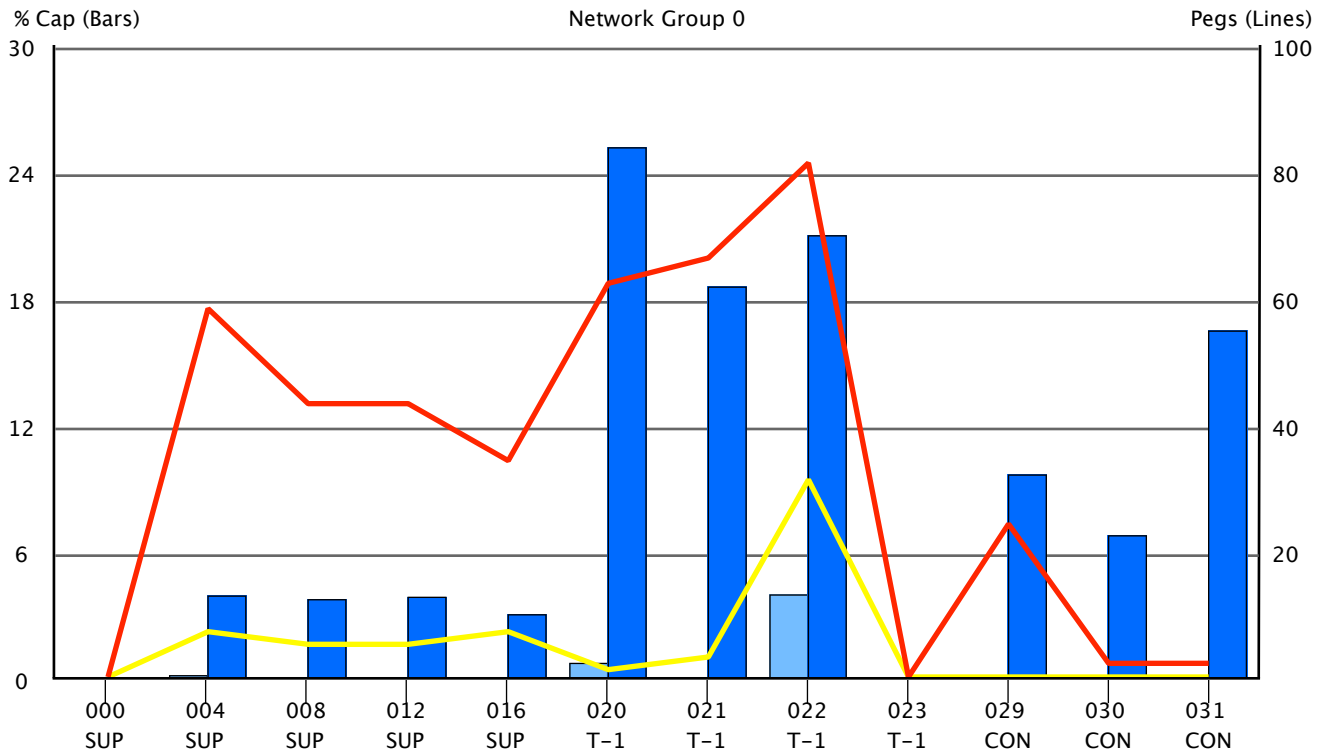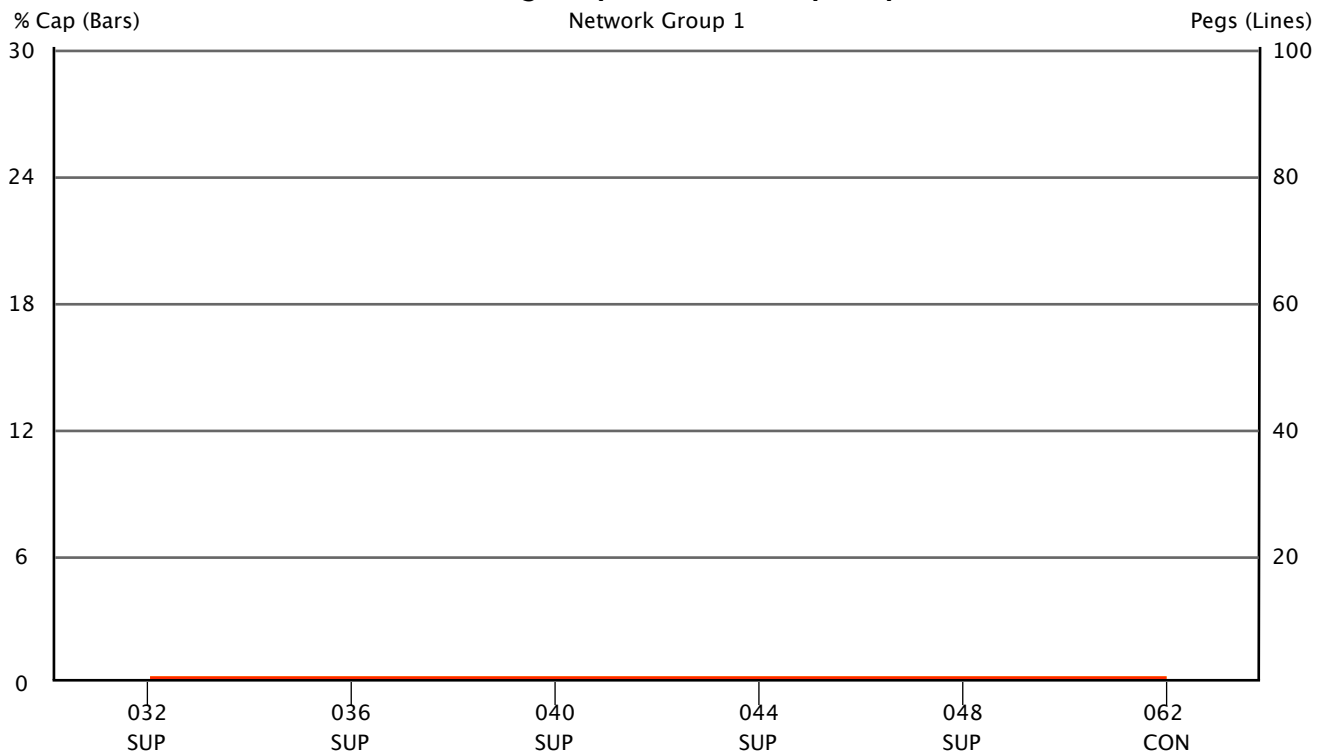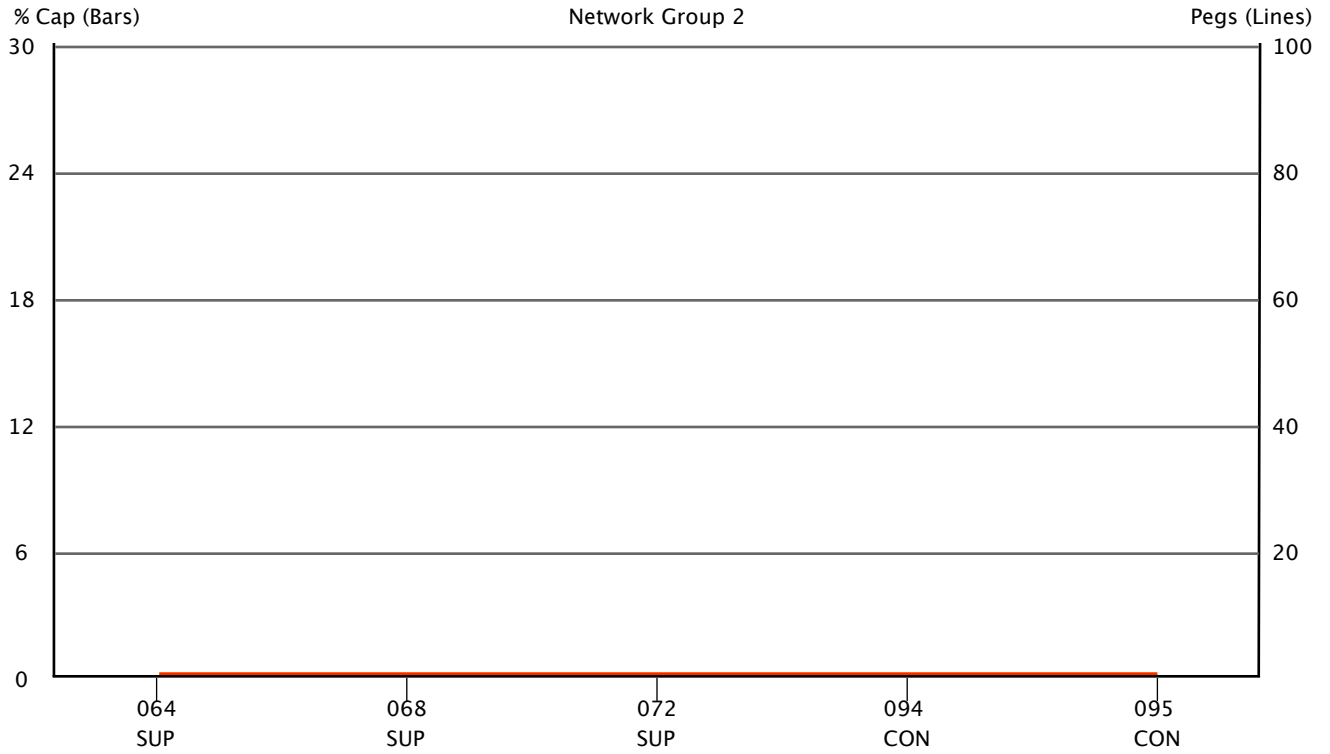
3. Junctors

3.1. Junctor Statistics

Junctors are the pathways which link multiple Network Groups together such that a terminal (a station or a Trunk) in one Network Group may connect to a terminal in any other Network Group. Each Junctor Group is identified by the two Network Groups it connects, e.g. 0–1 connects Network Group 0 to Network Group 1. Network Group 0 contains all terminals in Loops 0 thru 31, Network Group 1 contains Loops 32 thru 63, Network Group 2 contains Loops 64 thru 95, Network Group 3 contains Loops 96 thru 127, Network Group 4 contains Loops 128 thru 159, Network Group 5 contains Loops 160 thru 191, Network Group 6 contains Loops 192 thru 223, and Network Group 7 contains Loops 224 thru 255.

The chart below provides Maximum Busy Hour and Average Busy Hour Junctor Usage statistics accumulated over the study period. Ideally, Junctor traffic should be minimized and balanced. Communities of interest should be co–located within the same Network Group to minimize Junctor Traffic, and Junctor Traffic should be relatively equal between groups. Minimization of traffic and balance may be achieved by moving heavily trafficed resources from one Network Group to a less trafficed Network Group.

If more even balance is desired, use the Relative Junctor Activity Report along with the Bouncing Busy Loop Traffic Report to help determine which facilities to move and in what direction.

Junctor Statistics

Group From - To		----------------Maximum Busy Hour----------------					------Average Busy Hour------		
	Day	Hour	% Cap.	Usage (CCS)	FTM	% Cap.	Usage (CCS)	FTM
There are no junctors in this switch.								

3.2. Relative Junctor Activity

The graphic below depicts relative Junctor Group traffic taking place between the various Network Groups. To obtain relative traffic we summed all traffic for each Junctor Group for the entire study. The thickness of the line between any two Network Groups is an indication of the relative amount of traffic that Junctor Group carried, compared to all of the other Junctor Groups. The thicker the line, the more traffic it carried.

As each Network Group may be connected to one or more other Network Groups, we then summed the total Junctor traffic associated with each Network Group and expressed that sum as a percentage of average Junctor traffic for all groups. In general, traffic should be removed from the Network Group with the highest percentage of Junctor traffic to the Network Group with the lowest percentage of Junctor Traffic. You might want to refer to the Bouncing Busy Hour Loop Traffic Report to help identify specific Loops which might be moved to balance Junctor traffic and minimize Junctor activity.

There are no junctors in this switch.

4. Resource Allocation Failures

4.1. Failure to Match (FTM) Report

There are two possible types of Failures to Match – an IntraLoop FTM and an InterLoop FTM.

An IntraLoop FTM is registered when a connection cannot be made between two terminals in the same Loop, because all time slots for that Loop are busy.

An InterLoop FTM is registered when a connection cannot be made between two terminals on different Loops. An InterLoop failure will result in one FTM on each of the two Loops involved.

An InterLoop FTM may also be indicated if:

   a.   A connection cannot be made between a terminal or DTR and a Service Loop

   b.   A connection cannot be made between a 2500 set and a DTR

   c.   A terminal cannot form a new conference or add a new party to an existing conference.

Did You Know?

Once again, the InfoPlus SourceBook's 'Equipment List' section would be an excellent source document to identify the ports assigned to each Loop impacted by Failures to Match.

Failures to Match

Loop	Type	Number	FTM Type	Day	Hour	Pegs	CCS
020	PRI	2	INTRA	Thu 1/4/2018	12PM-1PM	1	0
020	PRI	2	INTRA	Thu 1/4/2018	4-5PM	0	0
020	PRI	1	INTER	Thu 1/4/2018	4-5PM	0	0
022	PRI	2	INTRA	Mon 1/8/2018	9-10AM	71	86
022	PRI	4	INTER	Mon 1/8/2018	9-10AM	71	86
022	PRI	2	INTRA	Tue 1/9/2018	10-11AM	59	96
022	PRI	2	INTER	Tue 1/9/2018	10-11AM	59	96

4.2. Dial Tone Delay

The Dial Tone Delay report gives details of any delay experienced in providing Dial Tone to users. The report consists of simple peg counts of three potential delay conditions. The first column of information list the count of all requests for Dial Tone which were delayed for 1 to 3 seconds. The second column lists similar information for calls delayed 3 to 10 seconds, while the last column provides a count of calls delayed greater than 10 seconds.

Delays in Dial Tone may indicate the need to add additional DTR cards to your system.

Dial Tone Delay

Day	Hour	Delay > 1 sec	Delay > 3 sec	Delay > 10 sec
Sat 1/6/2018	12PM-1PM	5	1	0
Sun 1/7/2018	12PM-1PM	8	3	1
Mon 1/8/2018	8-9AM	5	3	1
Mon 1/8/2018	10-11AM	6	2	2
Mon 1/8/2018	4-5PM	3	1	1

4.3. DSP Resource Blockage

Calls can be blocked on an IP Media Gateway due to a lack of Digital Signal Processor (DSP) resources, which perform signal translations on calls involving at least one non-IP (TDM) endpoint. DSP resources are provided to an IP Media Gateway by Media Services Cards or daughter-boards on the Media Gateway Controller card. The number of DSP resources necessary for a particular IP Media Gateway is a function of the number and nature of calls being processed through the gateway.

This report will highlight any times during the study period when calls were blocked on an IP Media Gateway due to a lack of DSP resources. It indicates when the blockage occurred, on which IP Media Gateway, the total number of DSP allocation attempts on that gateway for the hour, and the number of blocked attempts. Ideally, you will have sufficient DSP resources to handle your calling patterns, and there should be no blockages.

If there are any IP Media Gateways that experienced recurring DSP blockages during the study period, you may wish to either (a) increase the number of DSP resources available for that gateway by purchasing additional hardware, or (b) move some of the stations or trunks on the gateway to a different gateway with excess DSP capacity. To help determine which IP Media Gateway might be an appropriate choice for moving resources, you can refer to the section titled 'DSP Activity', and note gateways with no blockages and relatively no DSP allocation attempts.

DSP Resource Blockages

Day	Hour	IPMG	Loop / Shelf	Attempts	Blocks
Sat 1/6/2018	9-10AM	3	4 / 0	16	2
Sun 1/7/2018	9-10AM	5	8 / 0	21	2

4.4. Insufficient Bandwidth Blockage

Calls can be blocked on an IP Media Gateway due to insufficient bandwidth available to set up the call. The bandwidth required is a function of the quantity and nature of calls on the IP Media Gateway.

This report will highlight the times when one or more calls were blocked on an IP Media Gateway due to insufficient available bandwidth. Information collected in this report will show the day, hour, originating IP Media Gateway number, and the number of calls blocked as a result of this condition. Ideally you will have sufficient bandwidth to process all calls on the IP Media Gateway and you will have no blockages.

If there are any IP Media Gateways that experienced recurring Bandwidth Blockages during the study period, you may wish to either (a) modify the bandwidth that is allocated to your IP Media Gateways or (b) change your CODEC for Best Bandwidth Strategy to reduce the bandwidth required.

Insufficient Bandwidth Blockages

Day	Hour	IPMG	Loop / Shelf	Blocks
Fri 1/5/2018	8-9AM	3	4 / 0	1
Mon 1/8/2018	12PM-1PM	3	4 / 0	1

5. IP Telephony

5.1. IP Zone Traffic

IP Zones are used for the purpose of selecting a CODEC to be used for different types of calls. A specific strategy can be defined for IntraZone calls (calls made between two terminals in the same zone), and a separate strategy can be made for InterZone calls (calls made between two terminals in different zones). The strategy choice for each call type is either Best Quality (BQ) or Best Bandwidth (BB). With Best Quality, more bandwidth will be used, but voice quality will be very clear. With Best Bandwidth, less bandwidth will be used, but a noticeable amount of voice quality may be sacrificed.

The following pages provide information on IP Zone usage in your system. An analysis has been performed on each zone and has been compared with the customer configured bandwidth allotment in order to help you assess the need to increase or decrease bandwidth for Voice over IP (VoIP).

In the following graphs, light blue columns represent IntraZone peak bandwidth usage (expressed in percent), dark blue columns represent InterZone peak bandwidth usage, the yellow line represents IntraZone average bandwidth usage, and the red line represents InterZone average bandwidth usage. The graphs present the average hourly bandwidth usage experienced by each IP Zone for each hour of the day. The tables above the graphs provide further detail by, 1) highlighting the busiest hour during the study, and 2) averaging together each daily busy hour for each individual IP Zone.

VoIP Zone: 000

Maximum Busy Hour Traffic - Sun 1/7/2018 3-4PM

	# Calls	Percent	# Blocks	Peak % Bandwidth	Average % Bandwidth
IntraZone	0	0.0	0	15	0
InterZone	53	100.0	0	15	5
Totals	53	100.0	0		

Average Bouncing Busy Hour Traffic

	# Calls	Percent	# Blocks	Peak % Bandwidth	Average % Bandwidth
IntraZone	0.0	0.0	0.0	8.0	0.0
InterZone	38.0	100.0	0.0	8.0	3.0
Totals	38.0	100.0	0.0		

Average Daily Bandwidth by Hour
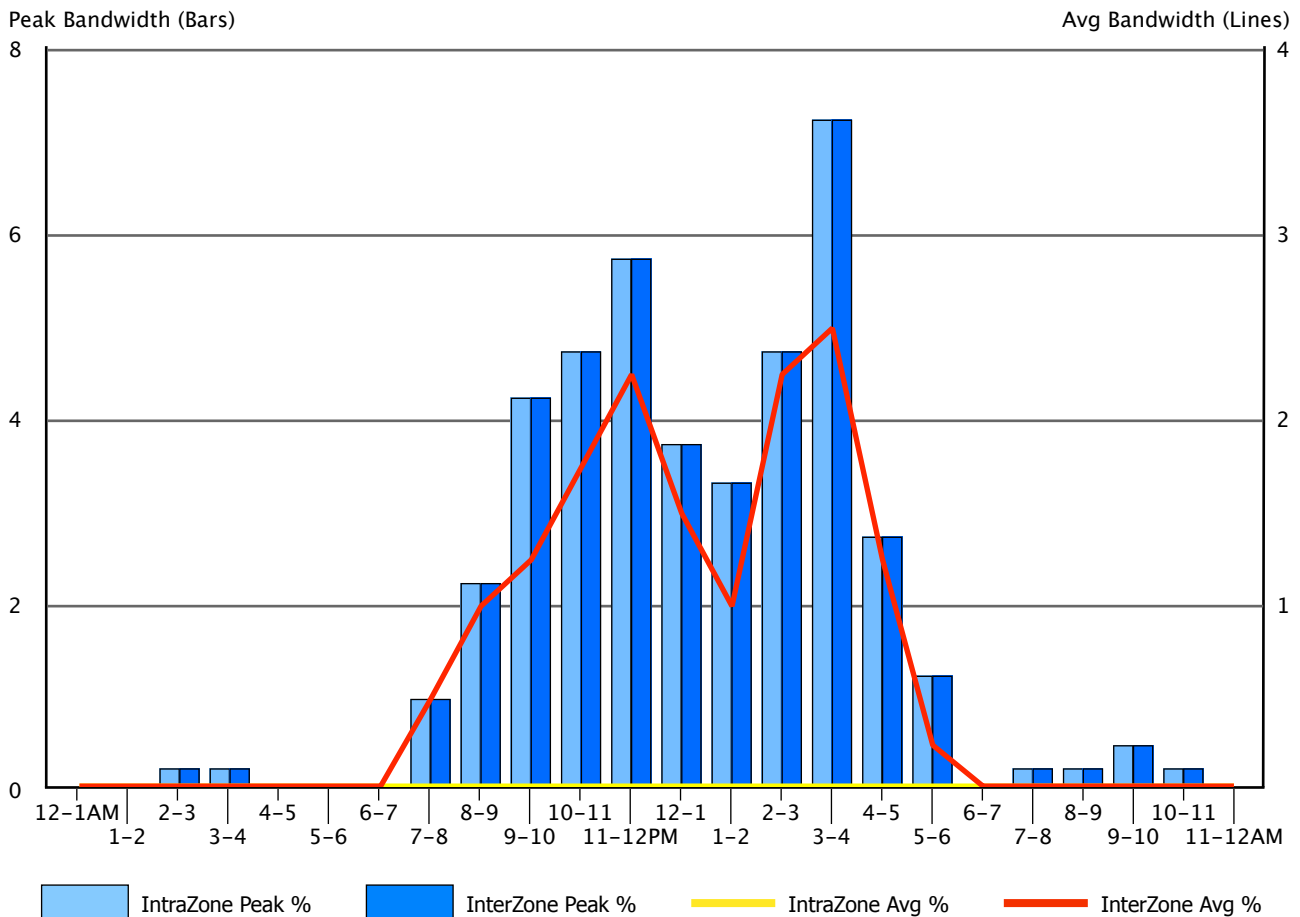
5.2. DSP Activity

IP Media Gateways rely on Digital Signal Processors (DSPs) to translate signals on calls involving at least one non-IP (TDM) endpoint. The number of DSP resources needed is a function of the quantity and nature of calls on the Media Gateway.

This report displays a graph for each IP Media Gateway summarizing the gateway's dependence on DSP resources and bandwidth over the course of a typical day. The bars of each graph show the average and peak number of DSP allocation attempts for each hour, and the lines indicate how many calls were blocked due to a lack of either DSP resources or bandwidth. Ideally, each gateway would have sufficient DSP resources and bandwidth such that no calls are blocked during your busiest periods. If blocking is occurring, you can reference the sections titled 'DSP Resource Blockage' and 'Insufficient Bandwidth Blockage' to get further details about those events.

By comparing the graphs of individual IP Media Gateways, you can balance the activity across them such that blocking is kept to a minimum. If moving resources between gateways is insufficient to prevent blockage, additional DSP hardware or an increase in bandwidth may be required. Please note that proper engineering of IP-based resources is critical to their functioning properly, and any balancing should be performed by qualified personnel.

IP Media Gateway 3 (Loop 4 / Shelf 0)

Avg. DSP Attempts   Peak DSP Attempts   Avg. DSP Blocks   Avg. Bandwidth Blocks

IP Media Gateway 5 (Loop 8 / Shelf 0)

Events (Bars & Lines)   DSP Activity
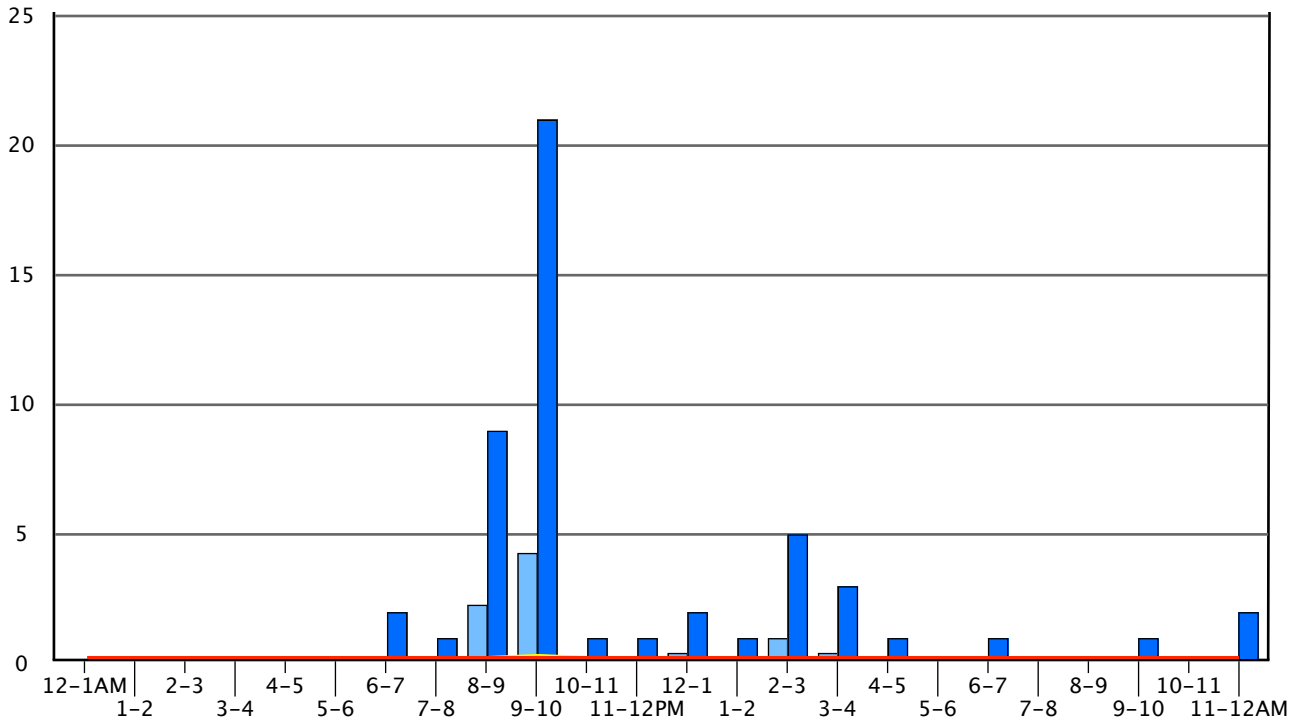
6. Trunking

6.1. Trunk Group Traffic

The following pages provide information on the usage of the Trunk Groups in your system. A traffic engineering analysis has been performed for each group to help assess the need to add or remove trunks, based strictly upon the levels of service for each Trunk Group. Yet the design of your network is based upon economics as well as service levels. To help you better understand the design of this network, the table at the bottom of this page describes the Route Lists in your system. Service levels may be adjusted without affecting the cost of usage by adding or disconnecting trunks from only the last Trunk Group in each Route List.

The following pages display information on each Trunk Group in your system. Using similar conventions as in previous graphs, light blue columns represent incoming usage (expressed in CCS), dark blue columns represent outgoing usage, the yellow line represents the number of incoming calls, and the red line represents the number of outgoing calls. The graphs present the average daily traffic experienced by each Trunk Group for each hour of the day. The tables above the graphs provide further detail by, 1) highlighting the busiest hour during the study, and 2) averaging together each daily busy hour for this Trunk Group.

An aggressive approach to service would use the 'Maximum Busy Hour Traffic' data for traffic engineering purposes, while a more conservative approach would use the 'Average Bouncing Busy Hour Traffic' data. The aggressive approach will yield better service, requiring more trunks. We have performed calculations for both sets of data and for three different service levels.

💡Did You Know?

While this InfoPlus Traffic Study will identify the volume and nature of calls handled by the Communication Server, an InfoPlus Security Audit will ensure all traffic was intended and appropriate usage. Also, the 'Route Lists' and 'Trunk Groups' sections of the SourceBook would add greater meaning and definition to the following pages.

Route Selection

An All Trunks Busy condition on an outgoing Trunk Group is something that your phone system can be configured to avoid. When all the Trunks are busy, incoming calls on that Trunk Group are denied, and outgoing calls cannot be made. However, on outgoing Trunk Groups, your Route Lists can be configured in such a way that if their first choice of Trunk Group is busy, the call can pass to the next choice, and so on. The table below shows all of the Route Lists in your Communication Server, along with the list of Trunk Groups those Route Lists are configured to use in priority order. This can aid you in determining the impact of any All Trunks Busy conditions that may be reported on the following pages.

When diagnosing All Trunks Busy conditions on outgoing Trunk Groups, you should focus on those Trunk Groups which appear as a last choice for any Route List. Outgoing calls are not denied unless there are no remaining Trunk Groups to fall back on, so the last choice Trunk Group should ideally be able to accommodate any overflow that might occur to prevent gaps in service.

Route List	Trunk Groups in selection order		
0	1	4	
1	0	1	4
2	1	4	
4	1	4	
6	1		
8	2	1	4
10	1	4	
18	2	1	4

Trunk Group: 0 - Main DID
Type: DID   **Equipped:** 23   **Working:** 23

Maximum Busy Hour Traffic - Sun 1/7/2018 10-11AM

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	120	56.9	44	80.0	4.5	
Outgoing Calls	91	43.1	11	20.0	13.8	
Overflow Calls			0	0.0		
Totals	**211**	**100.0**	**55**	**100.0**	**6.4**	**0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	13	12	11

Average Bouncing Busy Hour Traffic

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	65.7	50.5	30.1	77.8	3.6	
Outgoing Calls	64.3	49.5	8.6	22.2	12.5	
Overflow Calls			0.0	0.0		
Totals	**130.0**	**100.0**	**38.7**	**100.0**	**5.6**	**0.0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	10	9	8

Average Daily Traffic by Hour
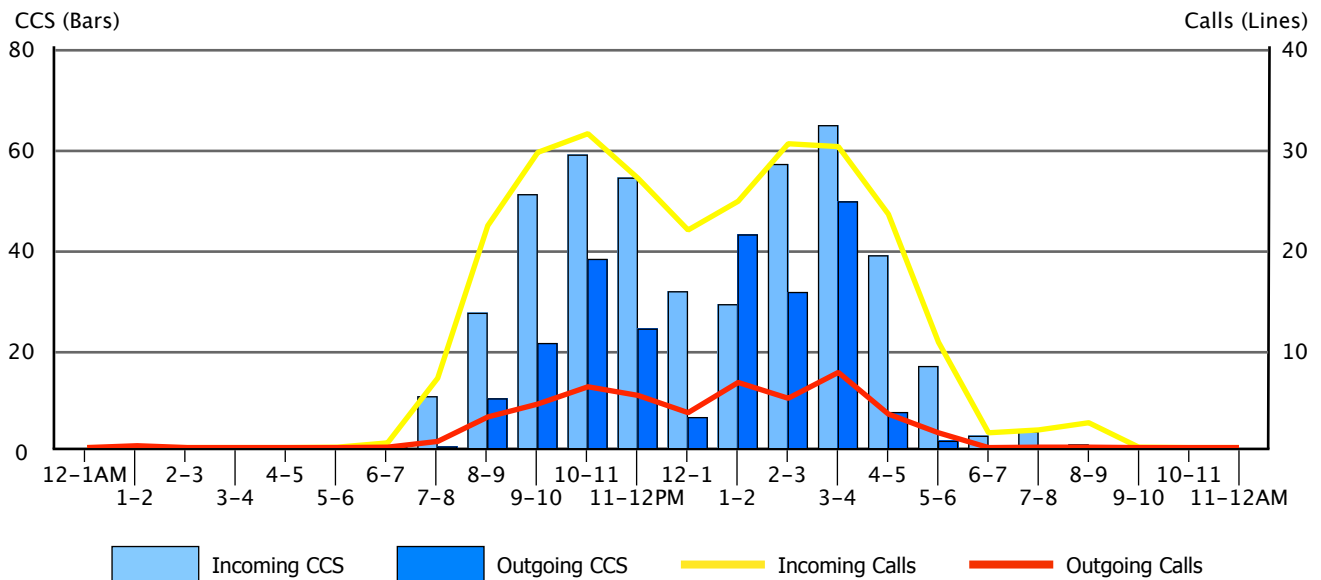
Trunk Group: 1 - Long Distance
Type: DID   **Equipped:** 23   **Working:** 23

Maximum Busy Hour Traffic - Mon 1/8/2018 2-3PM

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	0	0.0	0	0.0	--	
Outgoing Calls	161	100.0	59	100.0	4.5	
Overflow Calls			0	0.0		
Totals	**161**	**100.0**	**59**	**100.0**	**4.5**	**0**

Trunking Recommendations (using Erlang B)

Service Objective	P.01	P.02	P.05
Trunks Needed	11	10	8

Average Bouncing Busy Hour Traffic

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	0.0	0.0	0.0	0.0	--	
Outgoing Calls	85.6	100.0	30.3	100.0	4.7	
Overflow Calls			0.0	0.0		
Totals	**85.6**	**100.0**	**30.3**	**100.0**	**4.7**	**0.0**

Trunking Recommendations (using Erlang B)

Service Objective	P.01	P.02	P.05
Trunks Needed	7	7	6

Average Daily Traffic by Hour
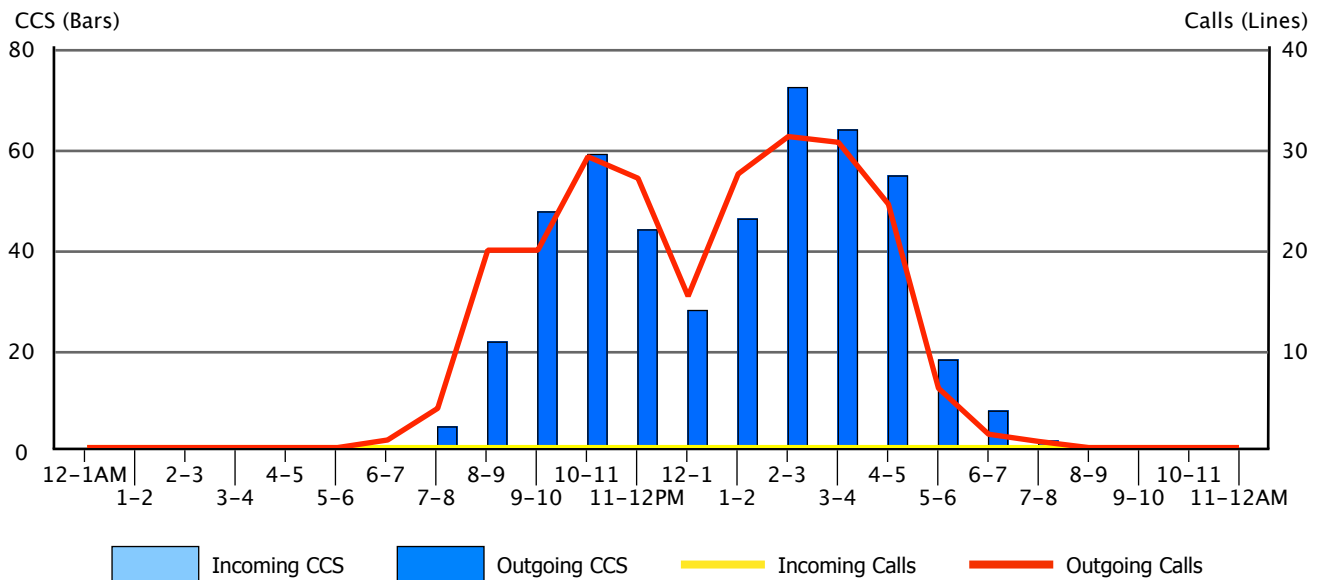
Trunk Group: 2 - West Coast TIE
Type: TIE   **Equipped:** 23   **Working:** 23

Maximum Busy Hour Traffic - Mon 1/8/2018 3-4PM

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	101	55.5	17	22.7	9.9	
Outgoing Calls	81	44.5	58	77.3	2.3	
Overflow Calls			0	0.0		
Totals	**182**	**100.0**	**75**	**100.0**	**4.0**	**0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	12	11	10

Average Bouncing Busy Hour Traffic

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	44.6	41.7	10.1	19.0	7.4	
Outgoing Calls	62.3	58.3	43.0	81.0	2.4	
Overflow Calls			0.0	0.0		
Totals	**106.9**	**100.0**	**53.1**	**100.0**	**3.4**	**0.0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	9	8	7

Average Daily Traffic by Hour
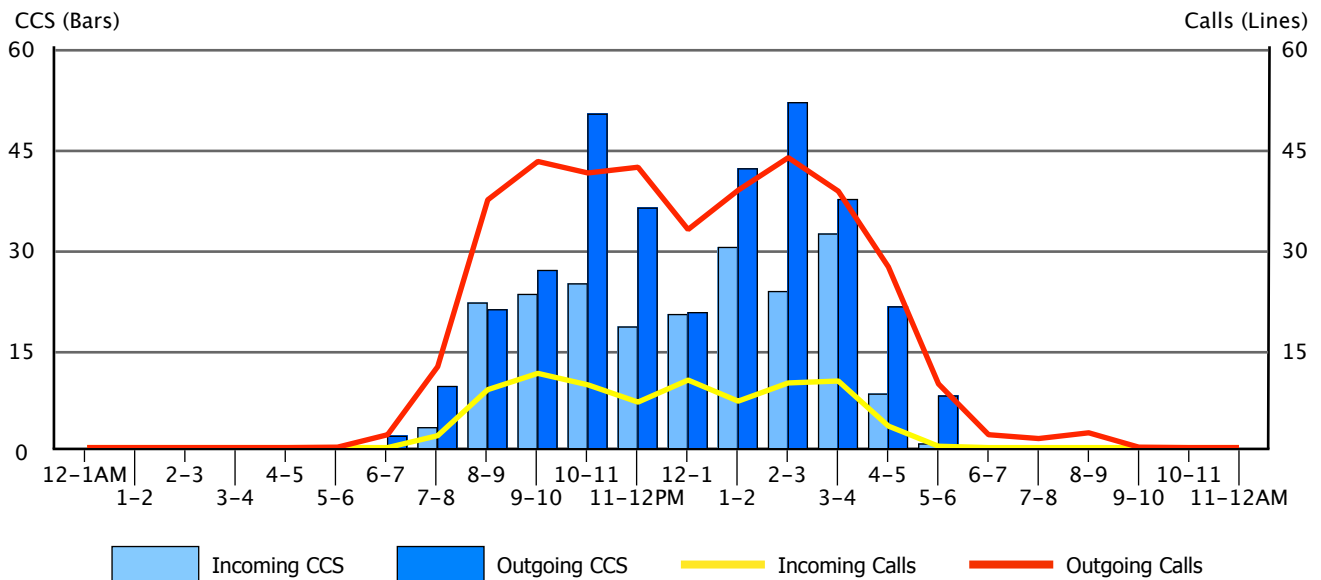
Trunk Group: 3 - Backup DID
Type: DID   **Equipped:** 8   **Working:** 8

Maximum Busy Hour Traffic - Thu 1/4/2018 5-6PM

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	0	0.0	1	100.0	0.0	
Outgoing Calls	0	0.0	0	0.0	--	
Overflow Calls			0	0.0		
Totals	**0**	**100.0**	**1**	**100.0**	**0.0**	**0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	1	1	1

Average Bouncing Busy Hour Traffic

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	0.0	0.0	0.6	100.0	0.0	
Outgoing Calls	0.0	0.0	0.0	0.0	--	
Overflow Calls			0.0	0.0		
Totals	**0.0**	**100.0**	**0.6**	**100.0**	**0.0**	**0.0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	1	1	1

Average Daily Traffic by Hour
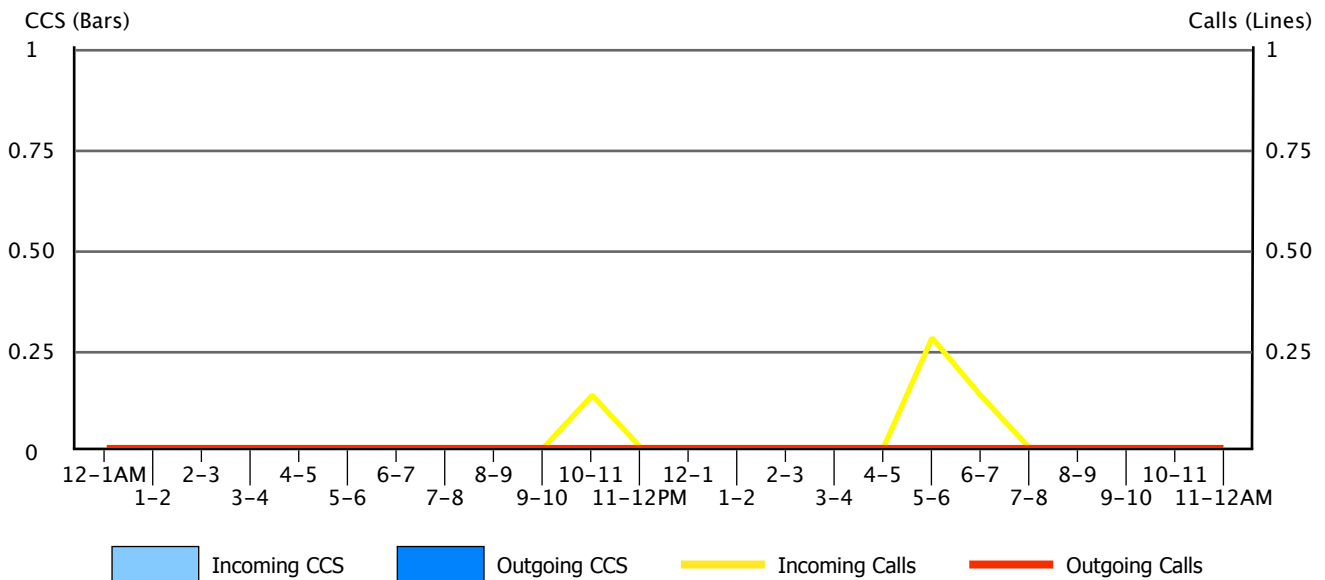
Trunk Group: 4 - Local Calls
Type: CO   **Equipped:** 7   **Working:** 7

Maximum Busy Hour Traffic - Fri 1/5/2018 4-5PM

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	1	100.0	1	100.0	1.7	
Outgoing Calls	0	0.0	0	0.0	--	
Overflow Calls			0	0.0		
Totals	**1**	**100.0**	**1**	**100.0**	**1.7**	**0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	2	2	1

Average Bouncing Busy Hour Traffic

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	0.1	100.0	0.6	100.0	0.3	
Outgoing Calls	0.0	0.0	0.0	0.0	--	
Overflow Calls			0.0	0.0		
Totals	**0.1**	**100.0**	**0.6**	**100.0**	**0.3**	**0.0**

Trunking Recommendations (using Erlang C)

Service Objective	P.01	P.02	P.05
Trunks Needed	1	1	1

Average Daily Traffic by Hour
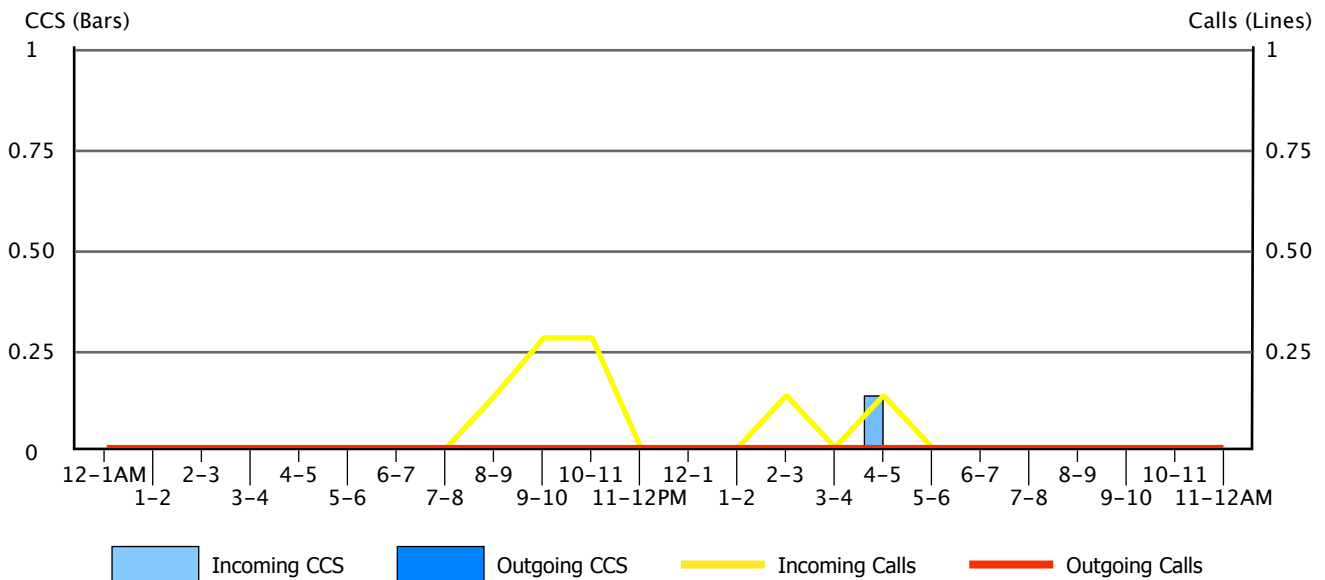
Trunk Group: 5 - Music on Hold
Type: MUS

Equipped: 1   **Working:** 1

Maximum Busy Hour Traffic - Sun 1/7/2018 10-11AM

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	0	0.0	0	0.0	--	
Outgoing Calls	7	100.0	5	100.0	2.3	
Overflow Calls			0	0.0		
Totals	**7**	**100.0**	**5**	**100.0**	**2.3**	**0**

Trunking Recommendations

Traditional trunking recommendations based on usage are not applicable for this trunk group type.

Average Bouncing Busy Hour Traffic

	Usage (CCS)	Percent	Peg Count	Percent	Min./Call	ATB
Incoming Calls	0.0	0.0	0.0	0.0	--	
Outgoing Calls	3.4	100.0	4.9	100.0	1.2	
Overflow Calls			0.0	0.0		
Totals	**3.4**	**100.0**	**4.9**	**100.0**	**1.2**	**0.0**

Trunking Recommendations

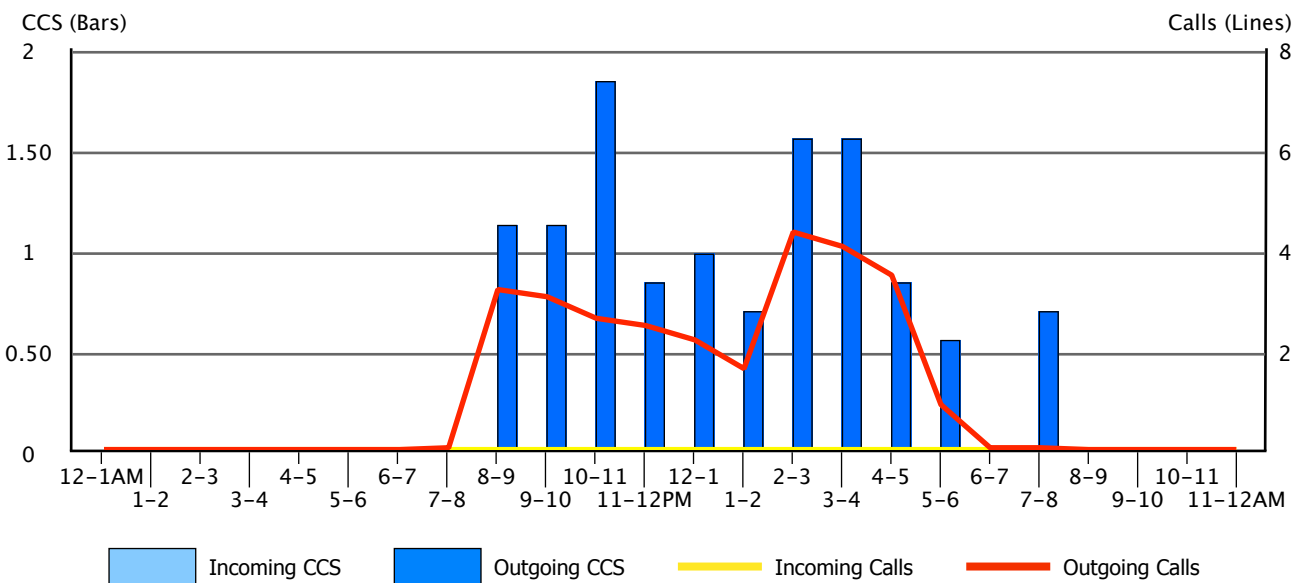*Traditional trunking recommendations based on usage are not applicable for this trunk group type.*

Average Daily Traffic by Hour

6.2. Trunking Worksheet

To make it convenient for you to note changes in your trunking that you may wish to make, we have provided a synopsis of each of the Trunking Reports. We again suggest that you check the Route Lists defined in the front of the Trunking Section before deciding to add any trunks used for outgoing or both–way usage. Determining the proper number and type of trunks for outgoing calls is usually an economic decision and not one based strictly on Service Objectives. This would be particularly true if the Trunk Group in question is at the beginning of the selection order.

In the worksheet below, the "DIR" column indicates the direction of the usage, whether Incoming, Outgoing or Both–way. Service Objective levels of P.01, P.02 and P.05 have been calculated for both the Maximum Busy Hour and for the average of each day's Busy Hour. The Service Objective is the statistical probability that calls will be blocked during the hour.

💡 **Did You Know?**

As many of these Trunk Groups may overflow to other Trunk Groups, one should not make decisions to add trunks to any group based solely on the information contained in this summary. For better decision making, the 'Route Lists' section of the InfoPlus SourceBook should be consulted before initiating significant changes.

Trunking Recommendations

Grp	Type	Dir	# Eqpd	# Wrkg	Max Busy Hour P.01	Max Busy Hour P.02	Max Busy Hour P.05	Avg Busy Hour P.01	Avg Busy Hour P.02	Avg Busy Hour P.05	Add/Delete
0	DID	Both	23	23	13	12	11	10	9	8	
1	DID	Out	23	23	11	10	8	7	7	6	
2	TIE	Both	23	23	12	11	10	9	8	7	
3	DID	In	8	8	1	1	1	1	1	1	
4	CO	In	7	7	2	2	1	1	1	1	

6.3. Trunk Group Bandwidth Utilization

Introduction to Bandwidth Analysis

This section provides bandwidth engineering projections for each call-carrying Trunk Group that generated traffic during the course of the study. To make the analyses clear, the selected Trunk Groups have been split into two categories: those that are already IP (Virtual Trunk Groups) and those that are not IP (TDM/Analog Trunk Groups). Virtual Trunk Groups are presented first, followed by any remaining Trunk Groups.

When considering the capacity of your WAN link for voice traffic, sufficient bandwidth should be purchased such that the peak values can be handled for brief periods of time without disrupting other services sharing the link, and the average bandwidth should be available at all times to ensure adequate voice quality. To illustrate the relationship between peak and average bandwidth, the following three analyses have been performed.

Peak Bandwidth Engineering: This section calculates the peak concurrent connections and the theoretical peak bandwidth. This bandwidth represents the potential maximum bandwidth contribution a Trunk Group can make to the downstream WAN link.
Average Busy Hour Bandwidth: The calculation in this section shows you how much bandwidth a Trunk Group utilizes, on average, during your busiest hours.
Average Daily WAN Bandwidth: The graph in this section depicts Peak and Average bandwidth utilization for the specified Trunk Group over the course of a typical day.

Interpreting the Data

For Virtual Trunk Groups, the analyses can be used to assess whether or not bandwidth consumption falls within existing engineering tolerances. This information should be compared to prior engineering calculations or direct measurements to ensure sufficient bandwidth is maintained over time. Understanding these key aspects of your IP Peer network are vital for analyzing performance and re-engineering.

For TDM/Analog Trunk Groups, the analyses provide a pre-engineering assessment of theoretical peak and average bandwidth requirements necessary when migrating a Trunk Group to IP. The information will help you to engineer tolerances for a lean network, and to carry out a migration in a cost efficient manner.

The tables above the graph provide key engineering tolerances, while the graph at the bottom juxtaposes the theoretical peak bandwidth and the average busy hour bandwidth for your 'Average Day'. On the graphs, the dark blue bars represent theoretical peak bandwidth and the red line represents the average bandwidth.

When considering what Grade of Service (GoS) to use for engineering Virtual Trunk Groups, P.01 should be used when there is no fall-back TDM route, or any other means of preventing blocking. Using P.01 for Trunk Groups that do not have a fall-back strategy allows for the bursty nature of IP networks. However, if a Virtual Trunk Group has a fall-back strategy, such as an alternate TDM route, a GoS of P.10 can be used. A fall-back strategy allows for the use a smaller, less costly facility for the IP link.

Assumptions used for the calculations:

- Poisson was selected to calculate peak concurrent connections due to its slightly more conservative nature.
- For 'Average Bandwidth', 1 Erlang = 36 CCS represents a circuit fully saturated for the duration of one hour.
- If existing codecs are configured in your Communication Server, a codec is selected from among those configured. If no codecs are configured or a codec can't be selected, G.711 64kbps at 20ms is used.
- WAN bandwidth per call includes an 8 byte link-layer overhead. This approximates the average overhead for common WAN links such as PPP, ATM, and Frame-Relay.
- When a codec that is configured to use VAD is selected, a reduction of 35% is applied to all calculated bandwidth values.

Bandwidth for Trunk Group: 0 - Main DID
Type: DID

Peak Bandwidth Engineering:

1. Measured Trunk Group Usage:
   Max Busy Hour: 211.0 CCS (Sun 1/7/2018 10-11AM)
   Avg Bouncing Busy Hour: 130.0 CCS

2. Theoretical Peak Concurrent Connections (using Poisson):

Max Busy Hour		Avg Busy Hour	
P.01	**P.10**	**P.01**	**P.10**
13	10	10	7

3. Calculated Bandwidth Per Call:
   Codec: G.711, 64.0 kbps at 20 ms
   WAN Bandwidth Per Call: 83.20 kbps

4. Theoretical Peak WAN Bandwidth Requirements:

Max Busy Hour Bandwidth		Avg Busy Hour Bandwidth	
P.01	**P.10**	**P.01**	**P.10**
1.08 Mbps	0.83 Mbps	0.83 Mbps	0.58 Mbps

Average Busy Hour Bandwidth:

1. Average Usage:
   Max Busy Hour: 5.86 Fully Saturated Circuits (Erlangs)
   Avg Bouncing Busy Hour: 3.61 Fully Saturated Circuits (Erlangs)

2. Average Busy Hour Bandwidth:

Max Busy Hour	Avg Busy Hour
0.49 Mbps	0.30 Mbps

Average Daily WAN Bandwidth by Hour - (Peak vs. Avg)

Peak Theoretical Bandwidth   Average Theoretical Bandwidth

Bandwidth for Trunk Group: 1 - Long Distance
Type: DID

Peak Bandwidth Engineering:

1. Measured Trunk Group Usage:
   Max Busy Hour: 161.0 CCS (Mon 1/8/2018 2-3PM)
   Avg Bouncing Busy Hour: 85.6 CCS

2. Theoretical Peak Concurrent Connections (using Poisson):

Max Busy Hour		Avg Busy Hour	
P.01	P.10	P.01	P.10
11	8	8	5

3. Calculated Bandwidth Per Call:
   Codec: G.711, 64.0 kbps at 20 ms
   WAN Bandwidth Per Call: 83.20 kbps

4. Theoretical Peak WAN Bandwidth Requirements:

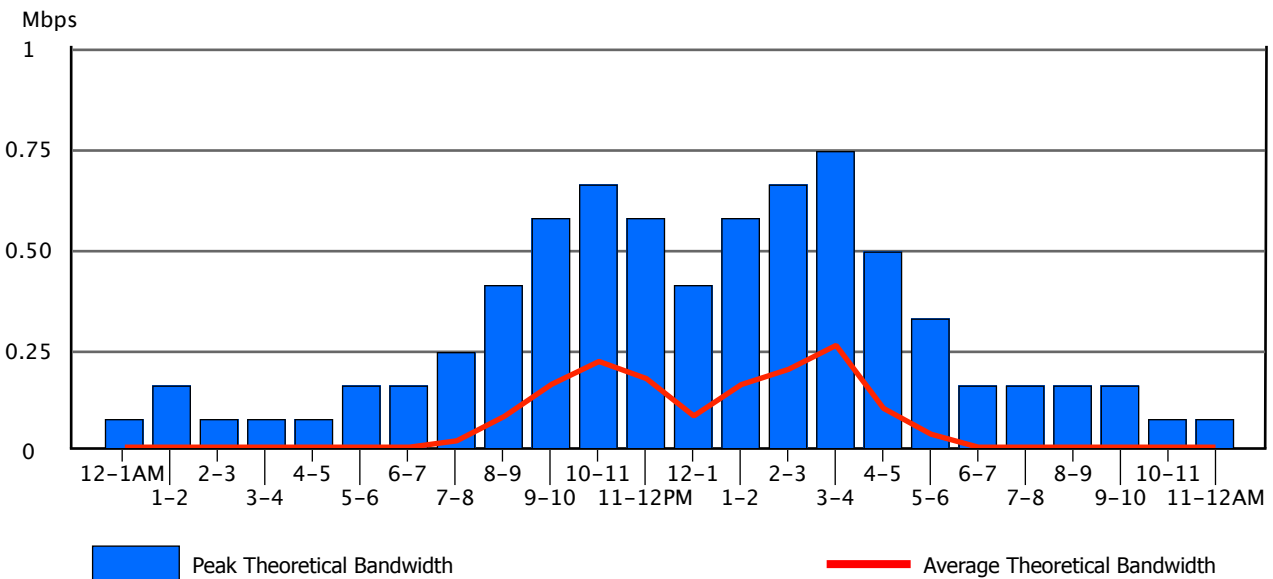| Max Busy Hour Bandwidth		Avg Busy Hour Bandwidth	
P.01	P.10	P.01	P.10
915.20 kbps	665.60 kbps	665.60 kbps	416.00 kbps

Average Busy Hour Bandwidth:

1. Average Usage:
   Max Busy Hour: 4.47 Fully Saturated Circuits (Erlangs)
   Avg Bouncing Busy Hour: 2.38 Fully Saturated Circuits (Erlangs)

2. Average Busy Hour Bandwidth:

Max Busy Hour	Avg Busy Hour
372.09 kbps	197.77 kbps

Average Daily WAN Bandwidth by Hour - (Peak vs. Avg)

Legend: ■ Peak Theoretical Bandwidth　　　— Average Theoretical Bandwidth

Bandwidth for Trunk Group: 2 - West Coast TIE
Type: TIE

Peak Bandwidth Engineering:

1. Measured Trunk Group Usage:
   Max Busy Hour: 182.0 CCS (Mon 1/8/2018 3-4PM)
   Avg Bouncing Busy Hour: 106.9 CCS

2. Theoretical Peak Concurrent Connections (using Poisson):

Max Busy Hour		Avg Busy Hour	
P.01	P.10	P.01	P.10
12	9	9	6

3. Calculated Bandwidth Per Call:
   Codec: G.711, 64.0 kbps at 20 ms
   WAN Bandwidth Per Call: 83.20 kbps

4. Theoretical Peak WAN Bandwidth Requirements:

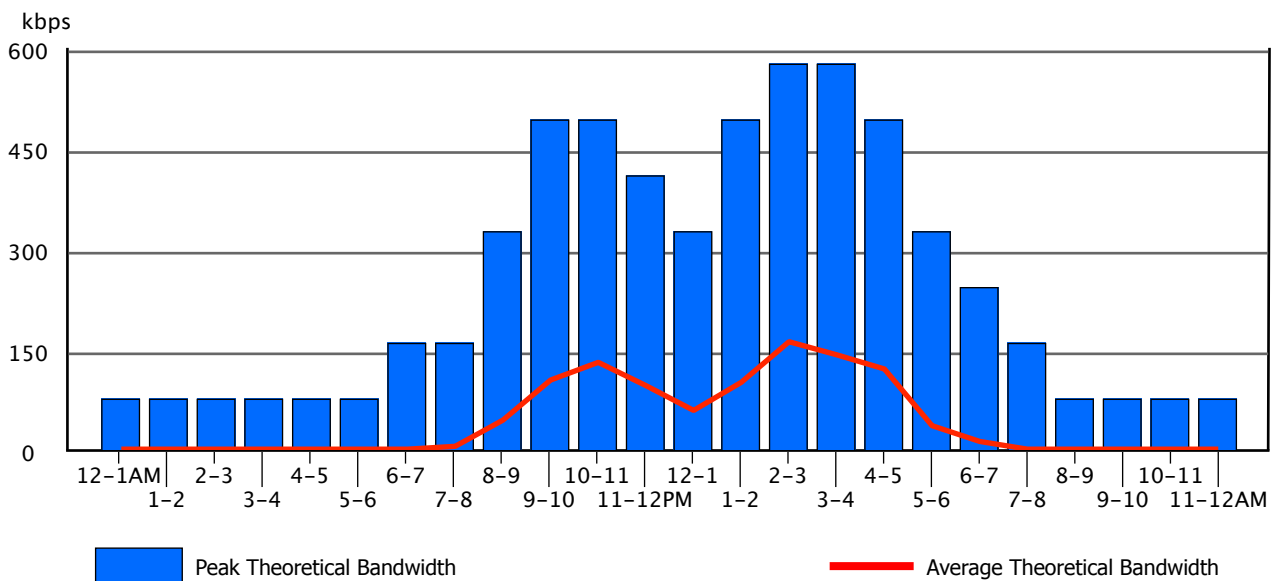| Max Busy Hour Bandwidth		Avg Busy Hour Bandwidth	
P.01	P.10	P.01	P.10
998.40 kbps	748.80 kbps	748.80 kbps	499.20 kbps

Average Busy Hour Bandwidth:

1. Average Usage:
   Max Busy Hour: 5.06 Fully Saturated Circuits (Erlangs)
   Avg Bouncing Busy Hour: 2.97 Fully Saturated Circuits (Erlangs)

2. Average Busy Hour Bandwidth:

Max Busy Hour	Avg Busy Hour
420.62 kbps	246.96 kbps

Average Daily WAN Bandwidth by Hour - (Peak vs. Avg)

Legend: Peak Theoretical Bandwidth (blue) — Average Theoretical Bandwidth (red)

Bandwidth for Trunk Group: 4 - Local Calls
Type: CO

Peak Bandwidth Engineering:

1. Measured Trunk Group Usage:
   Max Busy Hour: 1.0 CCS (Fri 1/5/2018 4-5PM)
   Avg Bouncing Busy Hour: .1 CCS

2. Theoretical Peak Concurrent Connections (using Poisson):

Max Busy Hour		Avg Busy Hour	
P.01	P.10	P.01	P.10
2	1	1	1

3. Calculated Bandwidth Per Call:
   Codec: G.711, 64.0 kbps at 20 ms
   WAN Bandwidth Per Call: 83.20 kbps

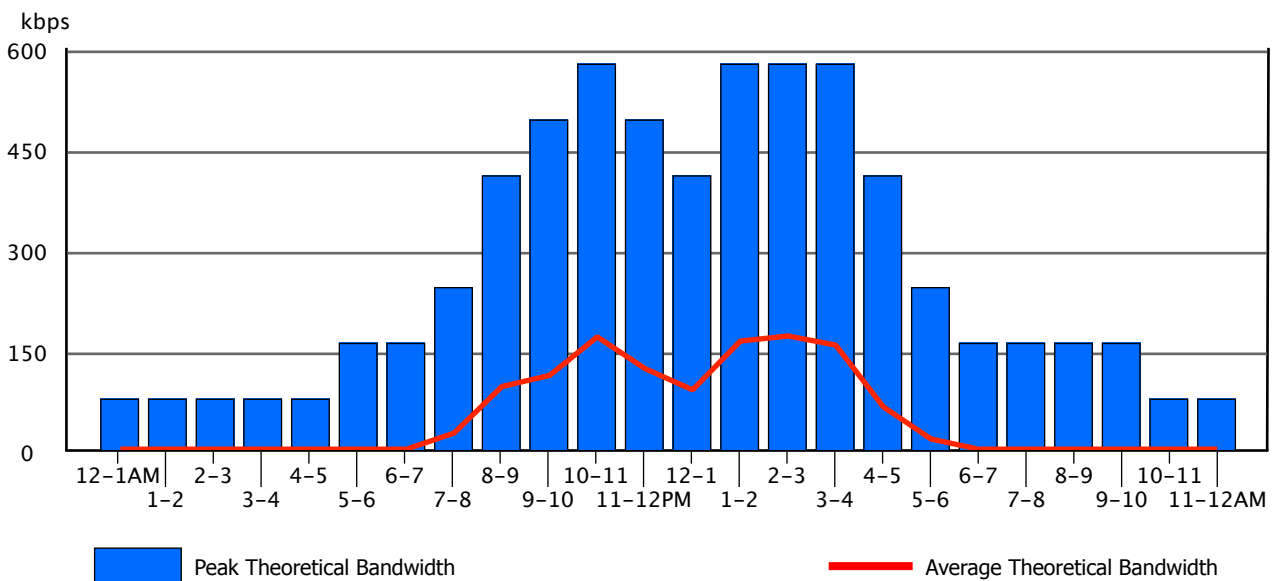4. Theoretical Peak WAN Bandwidth Requirements:

Max Busy Hour Bandwidth		Avg Busy Hour Bandwidth	
P.01	P.10	P.01	P.10
166.40 kbps	83.20 kbps	83.20 kbps	83.20 kbps

Average Busy Hour Bandwidth:

1. Average Usage:
   Max Busy Hour: 0.03 Fully Saturated Circuits (Erlangs)
   Avg Bouncing Busy Hour: 0.00 Fully Saturated Circuits (Erlangs)

2. Average Busy Hour Bandwidth:

Max Busy Hour	Avg Busy Hour
2.31 kbps	0.33 kbps

Average Daily WAN Bandwidth by Hour - (Peak vs. Avg)

Legend: ■ Peak Theoretical Bandwidth   ▬ Average Theoretical Bandwidth
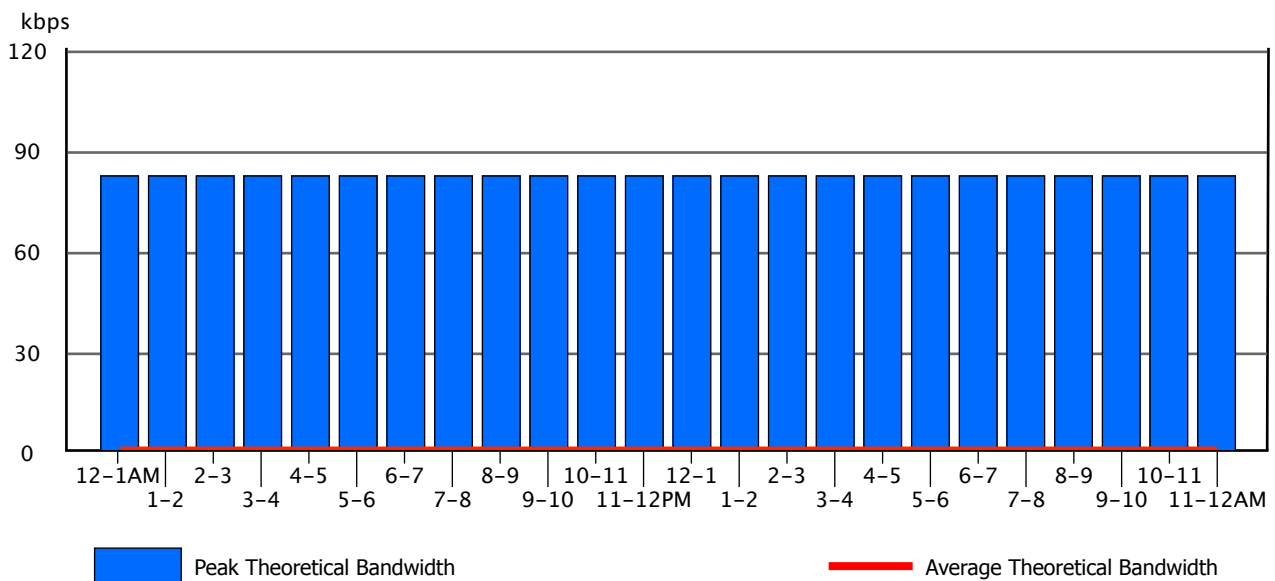
6.4. InfoPlus Aggregate Bandwidth Tool

About the Tool

This InfoPlus Traffic Study includes an online traffic analysis component in the form of a web application, the InfoPlus Aggregate Bandwidth Tool, which allows you to dynamically explore the network bandwidth required to support the voice traffic measured during the course of the study.

Moving traditional TDM/analog service to VoIP trunking or monitoring an existing deployment presents new engineering challenges. The InfoPlus Aggregate Bandwidth Tool allows you to apply your understanding of the voice traffic to the engineering process. Accurately calculating the bandwidth demands that will be placed on your IP facility will help to reduce your resource, engineering and maintenance costs.

As the data network is a shared facility, one cannot simply sum the maximum bandwidth requirements of individual Trunk Groups or Route Lists to determine their impact on the WAN. If multiple sources of traffic are being sent over the WAN, that activity must be combined at a low level before performing traditional traffic engineering calculations to determine the busy hour requirements. This tool allows you to select the sources of voice traffic that will be carried over a shared facility, and calculate the bandwidth requirements of that combined traffic using the actual data collected during this InfoPlus Traffic Study.

Benefits

The InfoPlus Aggregate Bandwidth Tool allows you to select and combine traffic sources in two ways:

- Usage by Trunk Groups
- Usage by Route Lists

From the resulting aggregate traffic, Peak and Average bandwidth utilization of a shared facility can be determined. This approach of selecting specific sources and combining their traffic usage before performing the analysis addresses key aspects of engineering bandwidth requirements:

- Accounting for overlapping and non-overlapping usage
- Allowing for fractional contributions from a given traffic source

These features help reduce costs by preventing over-provisioning of network resources when engineering new VoIP trunking deployments, and help to accurately monitor the bandwidth consumed by existing deployments. In addition, the tool allows you to explore multiple 'what if' scenarios by altering the parameters and assumptions of the VoIP trunking environment, and measuring their impact on the required network bandwidth.

With improved accuracy and timeliness of information, engineers and IT professionals will be able to design and monitor the network to meet the voice 'quality of service' standards the organization requires.

Accessing the Tool

You can access the InfoPlus Aggregate Bandwidth Tool for this Traffic Study by either clicking on the preceding link, or returning to the web page from which the report was originally downloaded. Once at the tool, you will find a brief tutorial to get you started, and a set of detailed instructions for the more advanced features.

If you have any questions about using the Aggregate Bandwidth Tool, or require further assistance, please contact us at support@infoplusonline.com

InfoPlus Traffic Aggregator

InfoPlus Aggregate Bandwidth Tool

Aggregate Sources   «

Routes | Route Lists

☑ Route 0   ▬▬▬▬● 100%
☑ Route 1   ▬▬▬▬● 100%
☑ Route 2   ▬▬●▬▬ 50%
☐ Route 3   ▬▬▬▬● 100%
☐ Route 4   ▬▬▬▬● 100%

Select multiple sources of voice traffic to aggregate - by Route or Route List

A percentage of each source may be selected to model usage assumptions

Aggregate Analysis

Peak Bandwidth Engineering:
1. Measured Aggregate Usage:
   Max Busy Hour: 373 CCS (Fri 3/12/2010 3-4PM)
   Avg Bouncing Busy Hour: 233.2 CCS

2. Theoretical Peak Concurrent Connections (using Poisson)

Max Busy Hour		Avg. Busy Hour	
P.01	**P.10**	**P.01**	**P.10**
20	16	14	11

3. Calculated Bandwidth Per Call:
   Codec: G.711, 64.0 kbps at 20 ms
   Bandwidth Per Call (with Overhead): 95.20 kbps

4. Theoretical Peak Bandwidth Requirements:

Max Busy Hour Bandwidth		Avg. Busy Hour Bandwidth	
P.01	**P.10**	**P.01**	**P.10**
1.90 Mbps	1.52 Mbps	1.33 Mbps	1.05 Mbps

Peak and average WAN bandwidth requirements are calculated from measured traffic statistics

Average Busy Hour Bandwidth:
1. Average Usage:
   Max Busy Hour: 10.36 Fully Saturated Circuits (Erlangs)
   Avg Bouncing Busy Hour: 6.48 Fully Saturated Circuits (Erlangs)

2. Average Busy Hour Bandwidth:

Max Busy Hour	Avg. Busy Hour
986.38 kbps	616.72 kbps

Daily graph depicts WAN consumption throughout an average day

Average Daily Bandwidth by Hour (Peak vs. Avg):

Explore different VoIP Codec parameters and see their effect on required WAN bandwidth

☑ Select All   Deselect All   ▦ Sort By ▾   🖫 Instructions   🖶 Print Version

Analysis Criteria   ⌄

Customer Info
Site Name:
Nortel CS1000 Demo

Customer #: **1234567890**

System Type:
Avaya CS1000

Timeframe
Start Date: 03/09/2010
End Date: 03/15/2010
Start Hour: 12:00 AM ▾
End Hour: 11:00 PM ▾

Codec
Codec: G.711 / 64k ▾
Sample Size: 20ms ▾
Net. Overhead: Ethernet ▾
VAD Enabled: ☐

Overall Growth
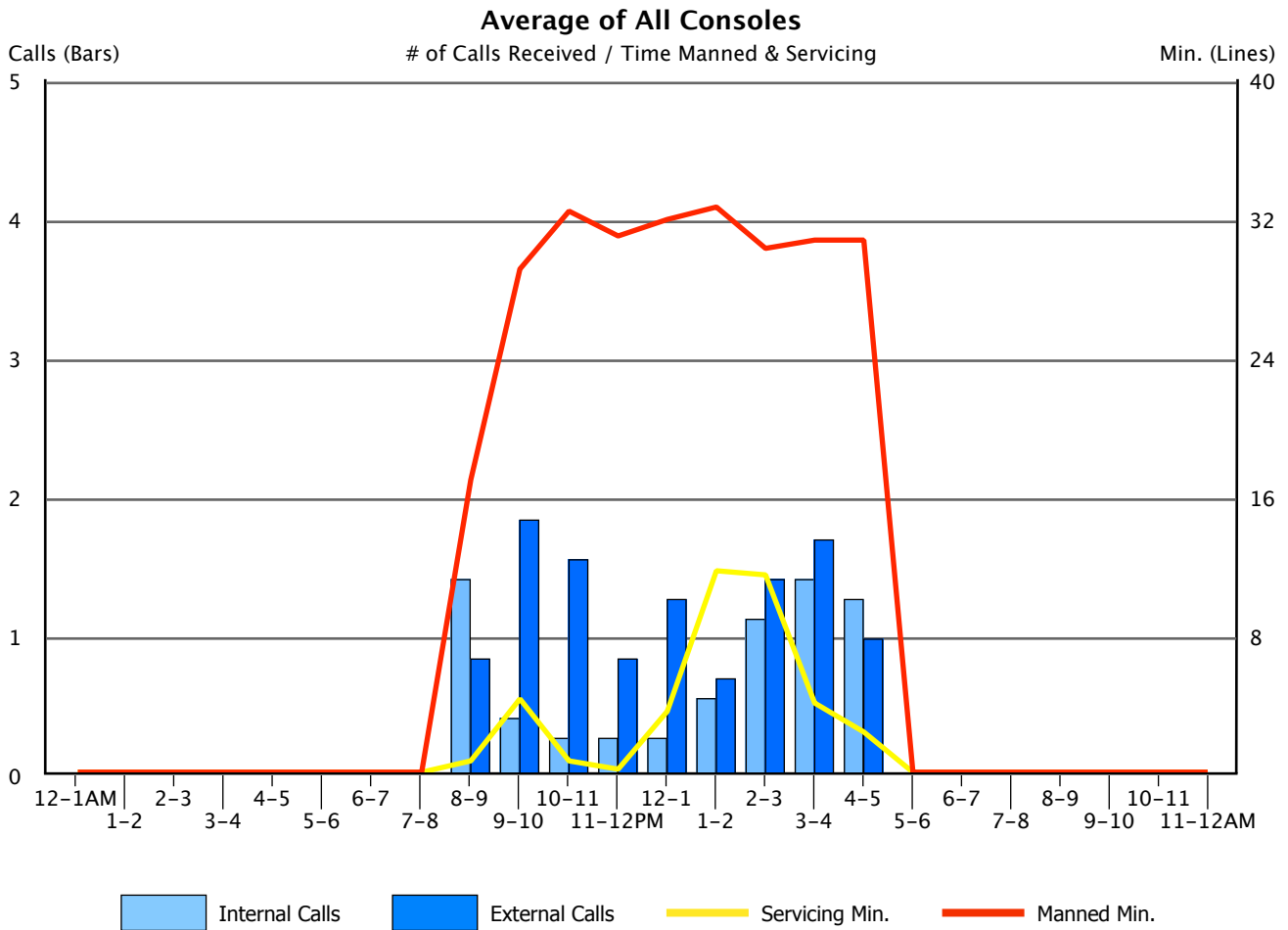-75% ▬▬●▬▬ +100%
Growth: 0%

🔁 Update Analysis

7. Console Activity

7.1. Console Work Load – Peg Counts of Calls

This graph shows the average number of calls handled by the console workforce per hour, and the average amount of time per hour the consoles were manned and servicing calls. The columns represent a peg count of calls, with light blue representing internal calls and dark blue representing calls coming in from the outside. The sum of the two columns will provide the total number of calls handled for the hour. The scale on the left hand side of the graph is used to interpret column data.
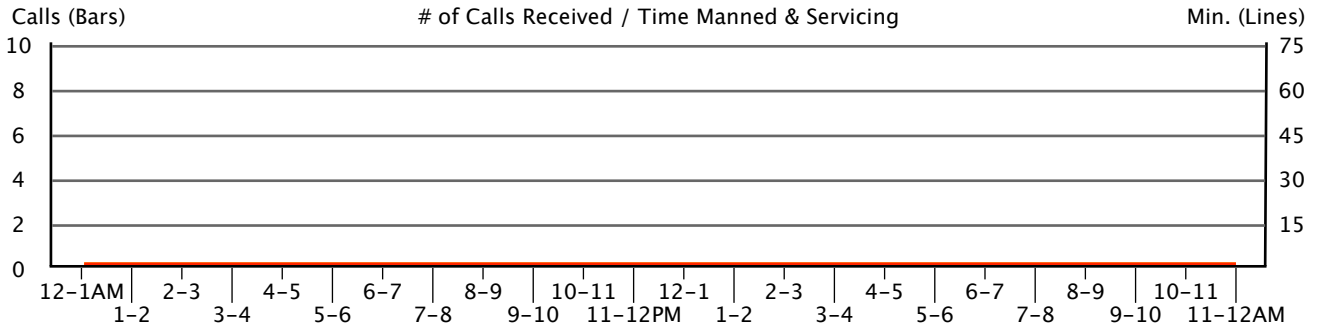
The lines indicate the amount of time (in minutes) the consoles were manned, and the amount of time actually spent servicing calls. The yellow line represents the amount of time spent in the servicing of calls, while the red line indicates the "manned" time during the hour. The "Min." scale on the right hand side of the graph is used to determine these values.

Following this section will be individual console statistics for each day, using the identical conventions established above.

Average of All Consoles

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)

| | Internal Calls | | External Calls | | Servicing Min. | | Manned Min. |

Internal Calls   External Calls   Servicing Min.   Manned Min.

Console 1 Thu 1/4/2018

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)

Console 1 Fri 1/5/2018

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)

Console 1 Sat 1/6/2018

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)

Console 1 Sun 1/7/2018

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)

Internal Calls   **External Calls**   **Servicing Min.**   **Manned Min.**

Console 1 Mon 1/8/2018

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)

Console 1 Tue 1/9/2018

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)

Console 1 Wed 1/10/2018

Calls (Bars)   # of Calls Received / Time Manned & Servicing   Min. (Lines)
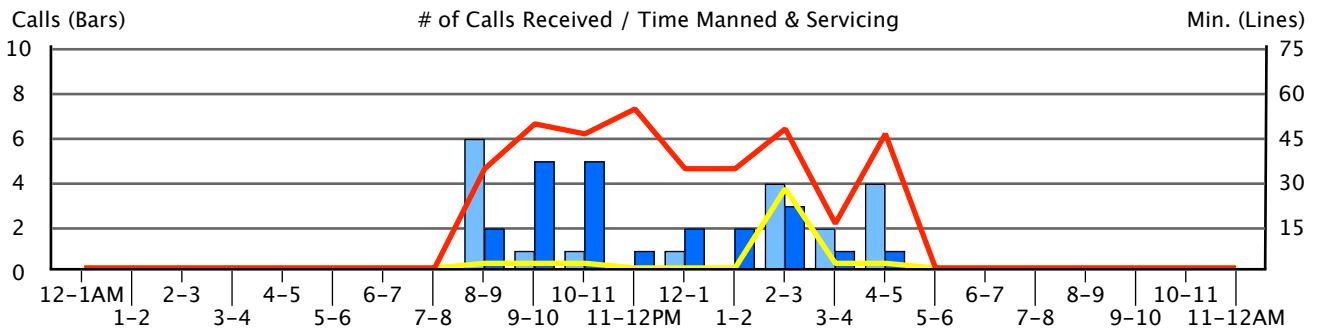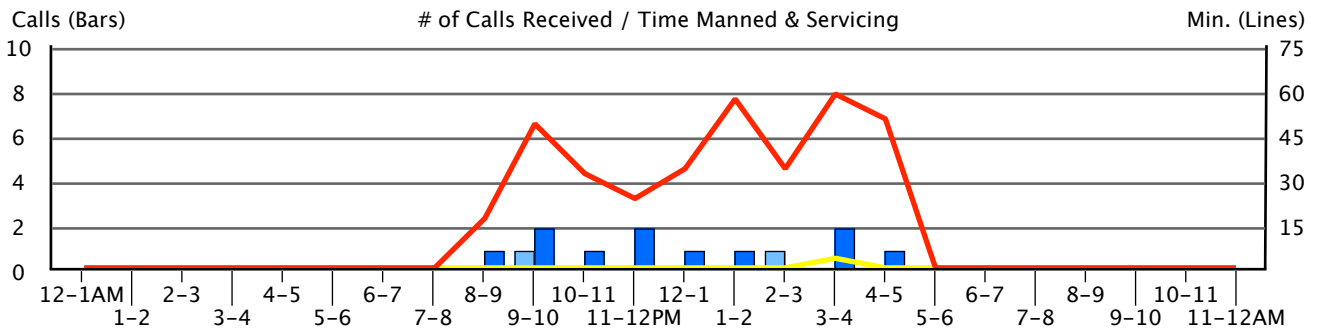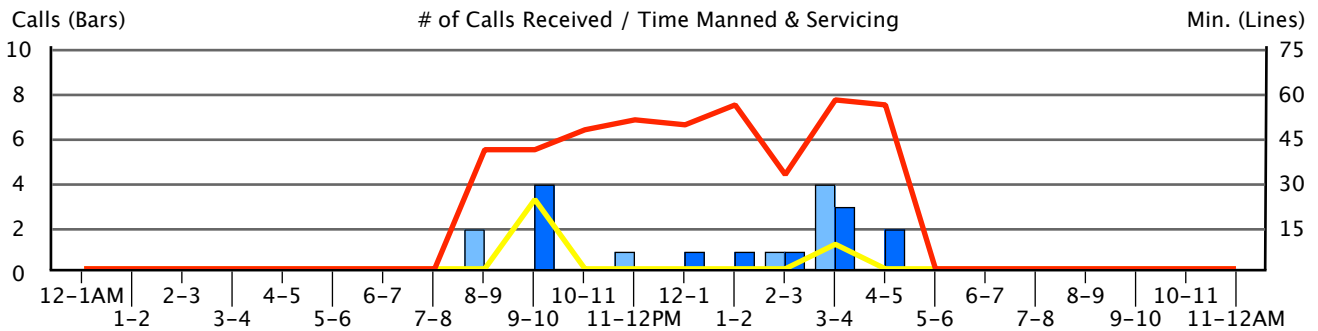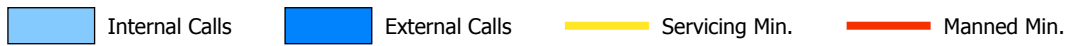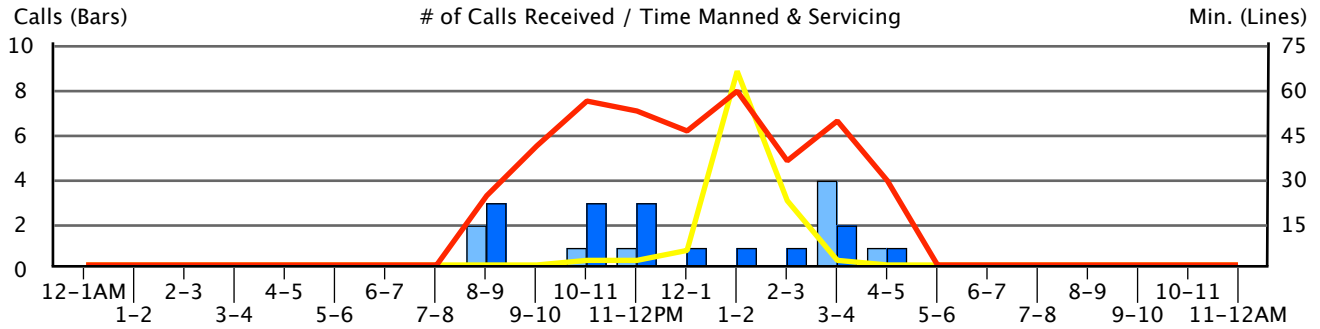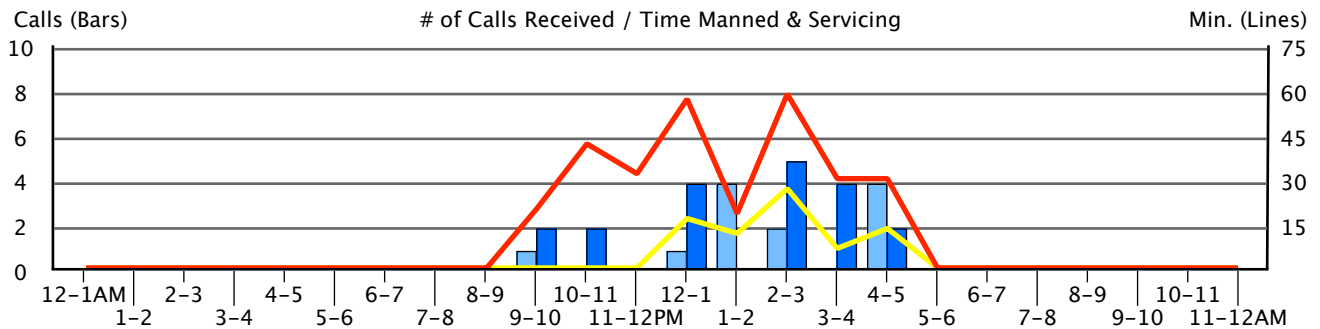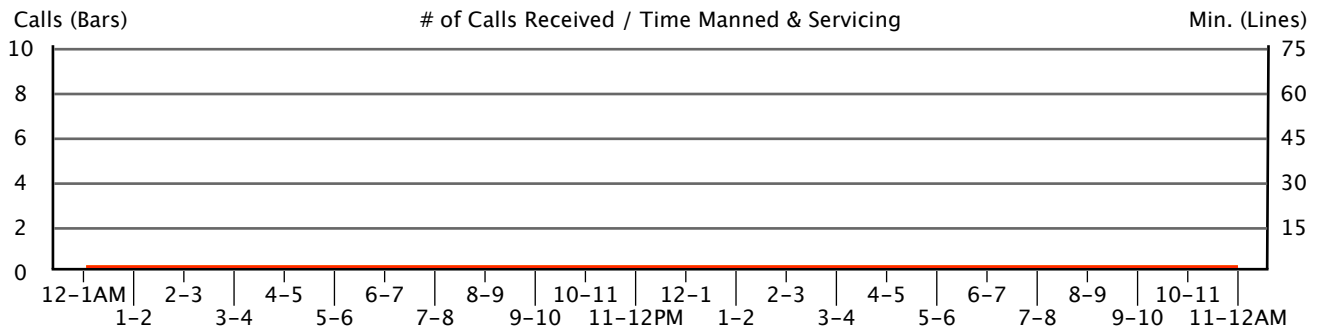
7.2. Console Time Spent in the Processing of Calls

This graph provides a breakdown, by hour, of the time spent servicing calls for all consoles during the study period. In these sets of graphs, the columns break down the servicing time between internal and external calls. The light blue columns represent the number of minutes per hour spent on internal calls, while the dark blue columns do likewise for external calls. The left hand scale is used to interpret this data.
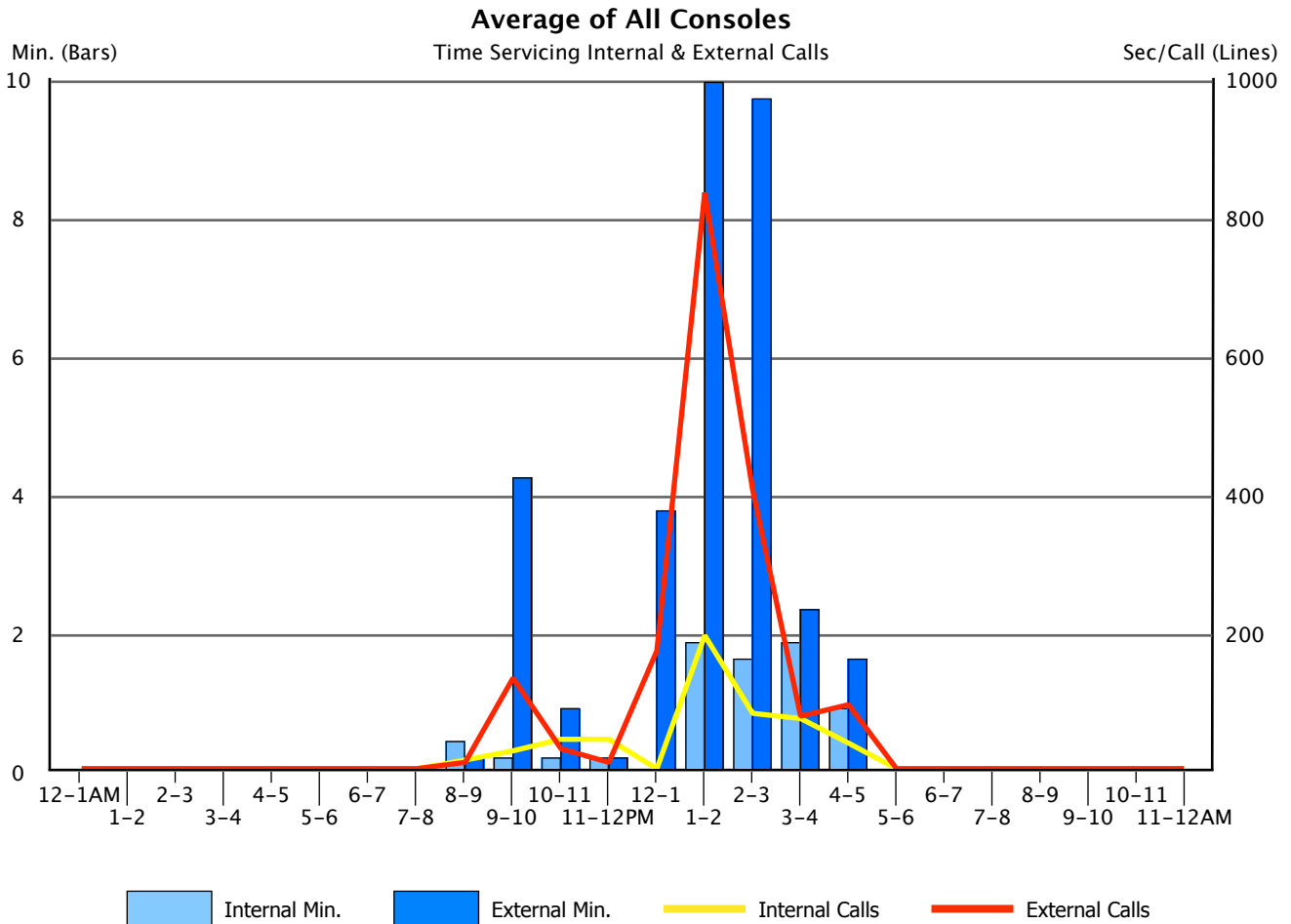
As an aid in determining overall operator efficiency, we have calculated the average number of seconds operators spend on both internal and external calls. The yellow line represents the average seconds per call for internal calls, while the red line is a similar calculation for external calls. The "Sec/Call" scale on the right hand side of the graph is used to determine these values.

Following this section will be individual console statistics for each day, using the identical conventions established above.

Average of All Consoles

Min. (Bars) | Time Servicing Internal & External Calls | Sec/Call (Lines)

Legend: Internal Min. | External Min. | Internal Calls | External Calls

Internal Min.   External Min.   Internal Calls   External Calls

Console 1 Thu 1/4/2018

Min. (Bars)   Time Servicing Internal & External Calls   Sec/Call (Lines)

Console 1 Fri 1/5/2018

Min. (Bars)   Time Servicing Internal & External Calls   Sec/Call (Lines)

Console 1 Sat 1/6/2018

Min. (Bars)   Time Servicing Internal & External Calls   Sec/Call (Lines)

Console 1 Sun 1/7/2018

Min. (Bars)   Time Servicing Internal & External Calls   Sec/Call (Lines)

Internal Min.   External Min.   Internal Calls   External Calls

Console 1 Mon 1/8/2018

Min. (Bars)   Time Servicing Internal & External Calls   Sec/Call (Lines)

Console 1 Tue 1/9/2018

Min. (Bars)   Time Servicing Internal & External Calls   Sec/Call (Lines)

Console 1 Wed 1/10/2018

Min. (Bars)   Time Servicing Internal & External Calls   Sec/Call (Lines)

8. Console Performance

8.1. Overlay Graphs

Generally, there are two overall factors which have a pervasive affect on console performance – the number of calls handled by the attendant force and the number of consoles manned. As the number of calls increase or the number of attendants decrease, we would expect overall console performance to suffer accordingly. Increases in delay times and abandoned calls would be symptomatic of increased activity.

To help assess these dynamics, we have developed the following overlays. The overlays graphically portray both the number of calls handled by the entire attendant force and the number of consoles manned for each hour, and for each day of the study. The number of consoles is actually a summation of the total manned timed for all consoles during a given hour, divided by 60 minutes, yielding the effective net number of consoles for that hour.

When placed upon a graph of "Abandoned Calls" for example, (matching the date of the overlay graph with the date of the Abandoned Calls graph) we will be able to see the impact call volume and staffing have on the number of Abandoned Calls and their average wait time. Similar analyses can be made for each day of the study period for the "Speed of Answer/Response" and "Delayed Calls" graphs.

Thu 1/4/2018

Consoles | Yellow = # Consoles | Green = # Calls | # Calls

Fri 1/5/2018

Consoles | Yellow = # Consoles | Green = # Calls | # Calls

Sat 1/6/2018

Consoles | Yellow = # Consoles | Green = # Calls | # Calls

Sun 1/7/2018

Consoles | Yellow = # Consoles | Green = # Calls | # Calls
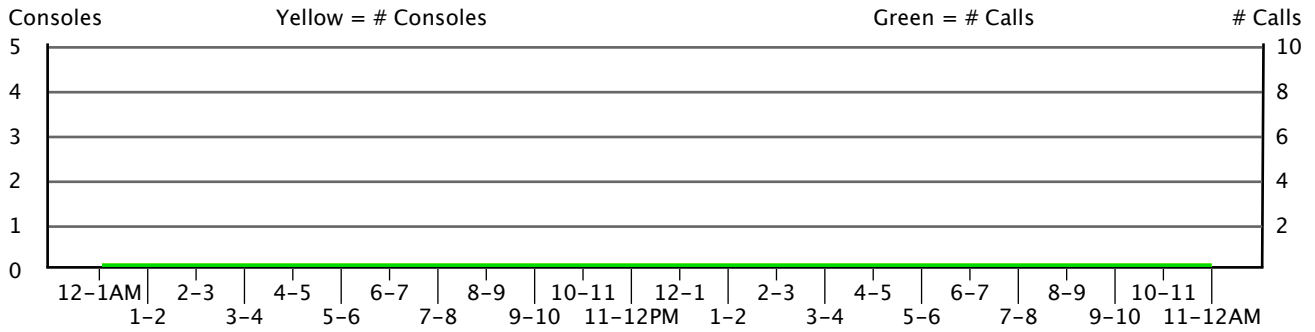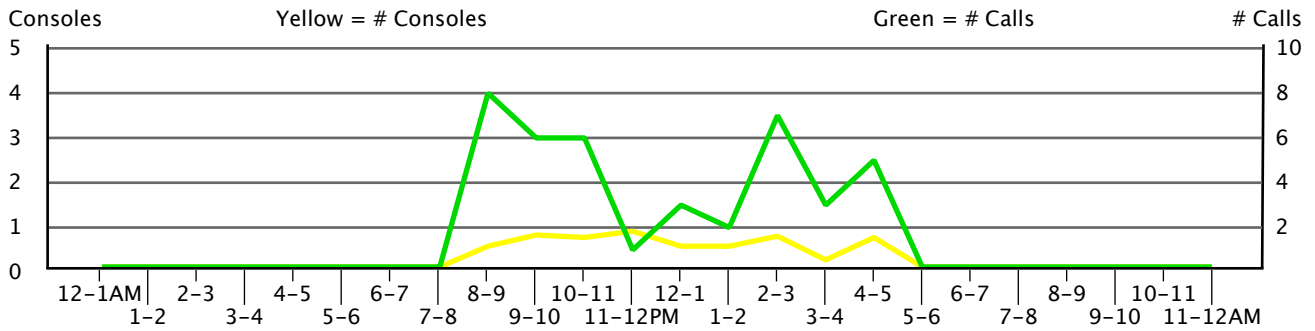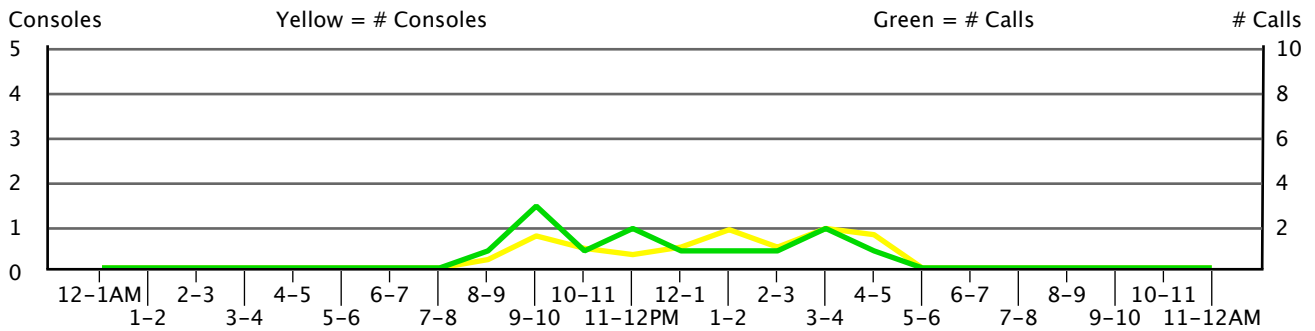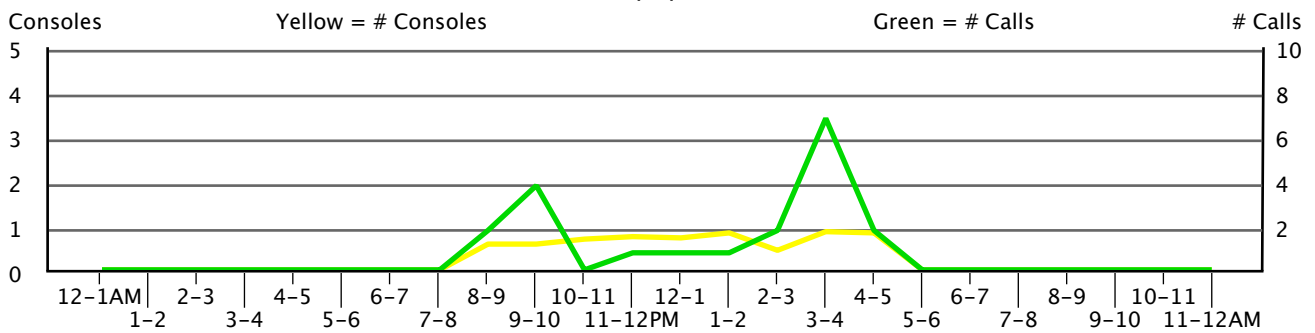
Mon 1/8/2018
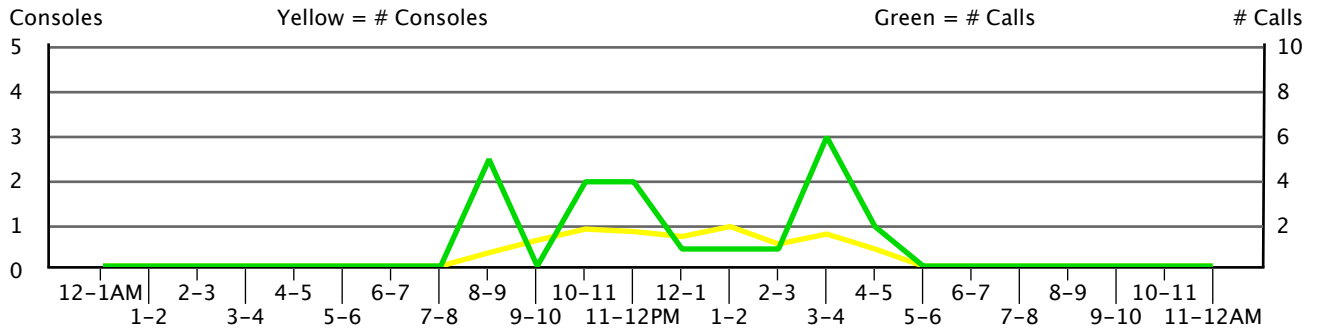
Tue 1/9/2018
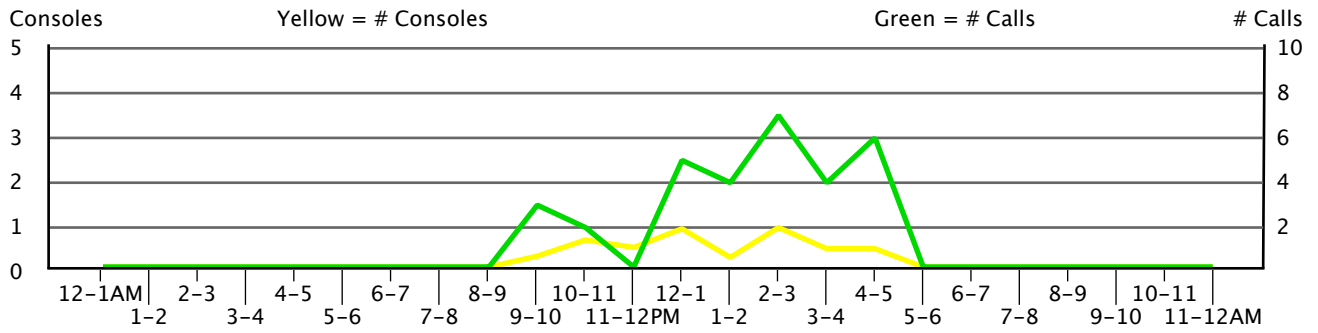
Wed 1/10/2018
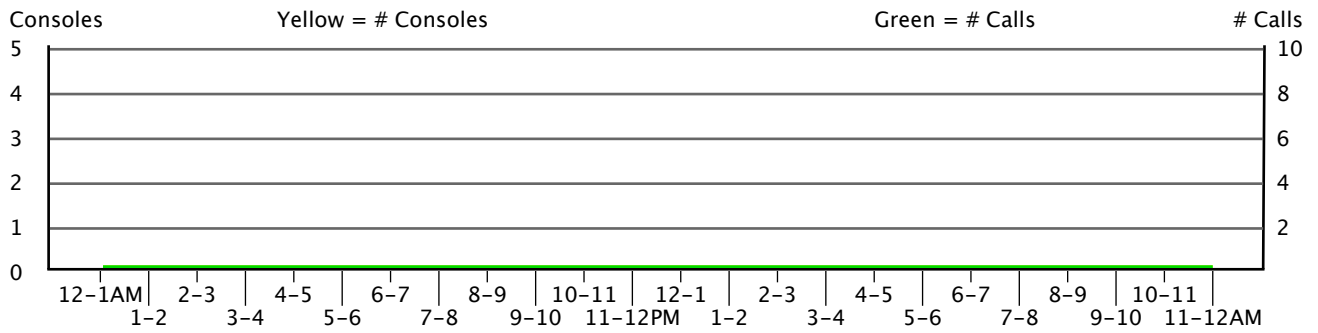
8.2. Speed of Answer/Response

This section shows attendant speed in responding to calls and the sufficiency of manned consoles. The blue line indicates how quickly the attendant responded to an indication of the next call. The red line indicates the average amount of time delayed calls had to wait for an attendant to answer (in number of rings). The difference between the two lines is an indication of the sufficiency of the number of console operators.

High response times would indicate a need to assess operator tasks. Low response times but high answer times may indicate a need for additional staff or consoles. Consult Appendix A in the back of this study for Manufacturer norms.

Nortel CS1000 Demo
Average Speed of Response/Answer

Thu 1/4/2018
Speed of Answer/Response

Fri 1/5/2018
Speed of Answer/Response

Answer   Response

Sat 1/6/2018

Rings   Speed of Answer/Response

Sun 1/7/2018

Rings   Speed of Answer/Response

Mon 1/8/2018

Rings   Speed of Answer/Response

Tue 1/9/2018
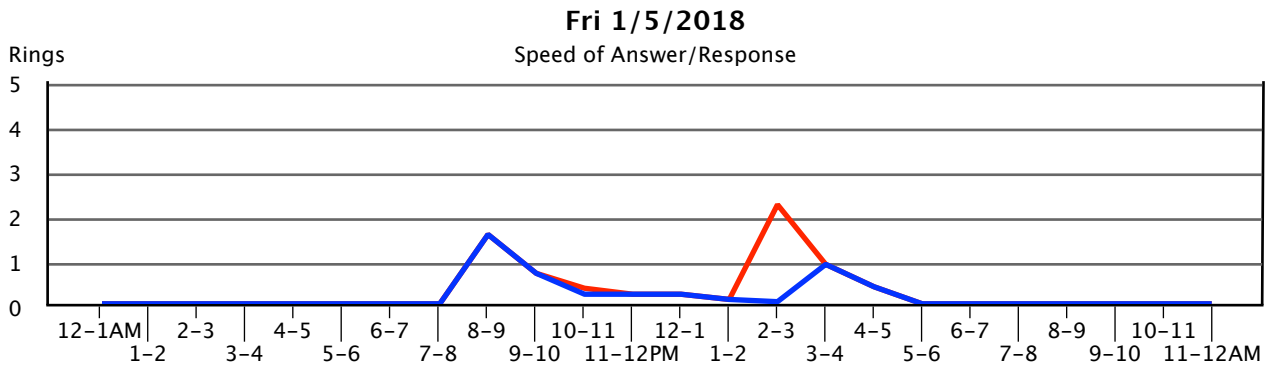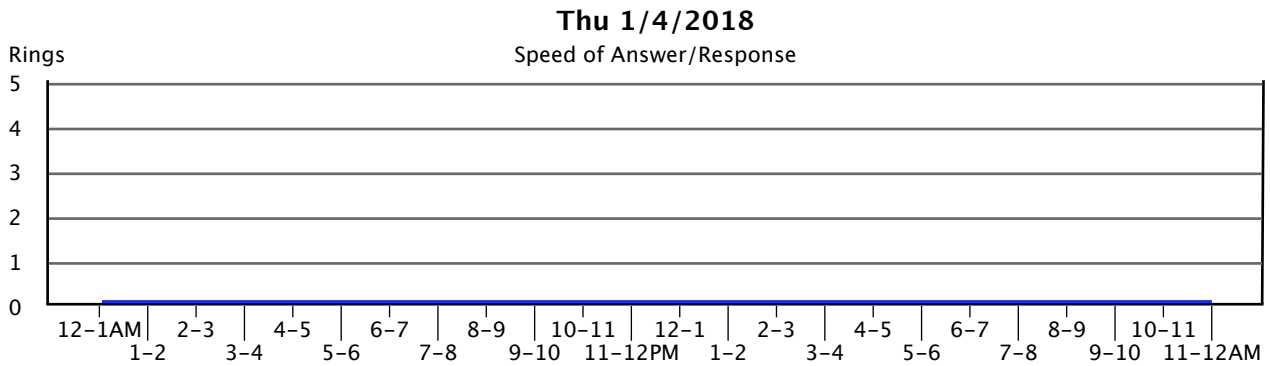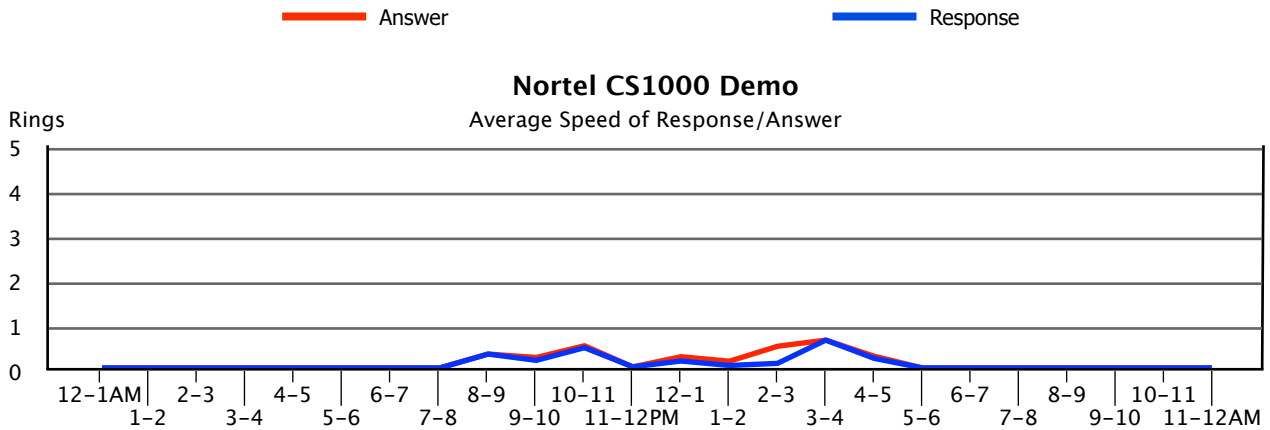
Rings   Speed of Answer/Response
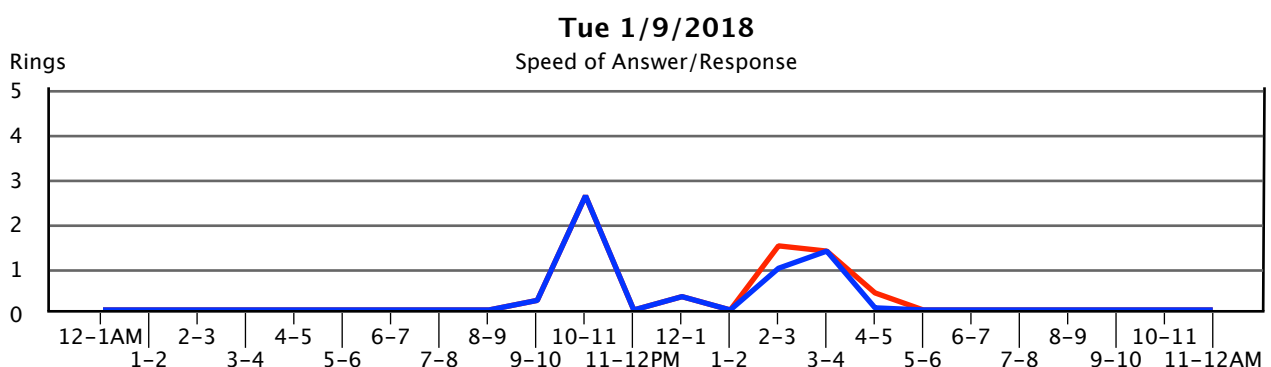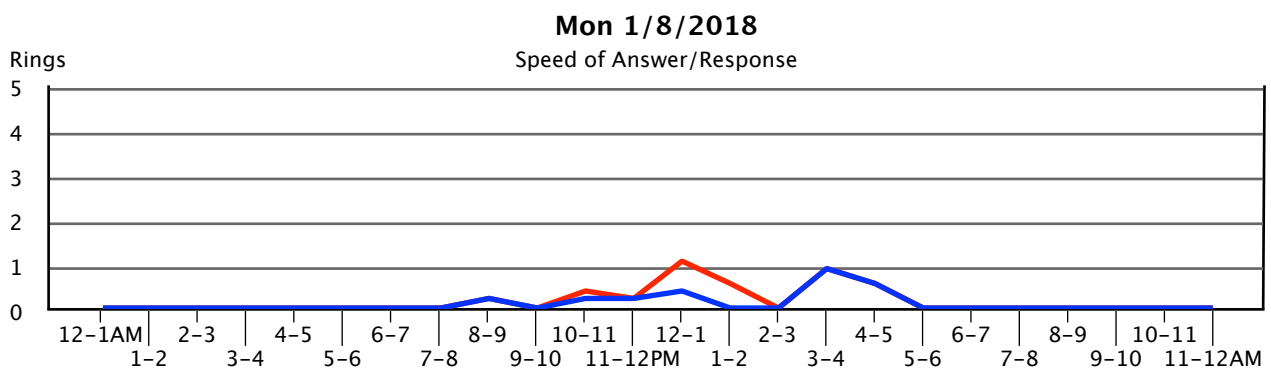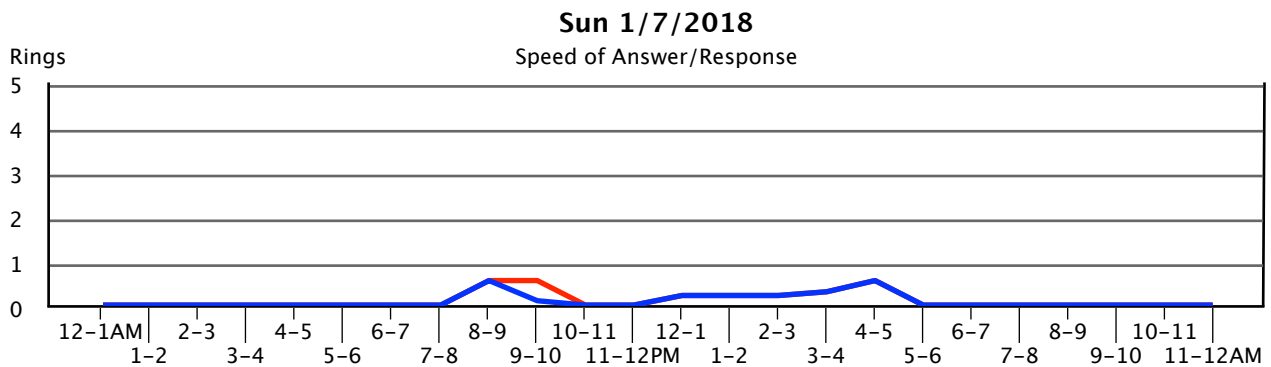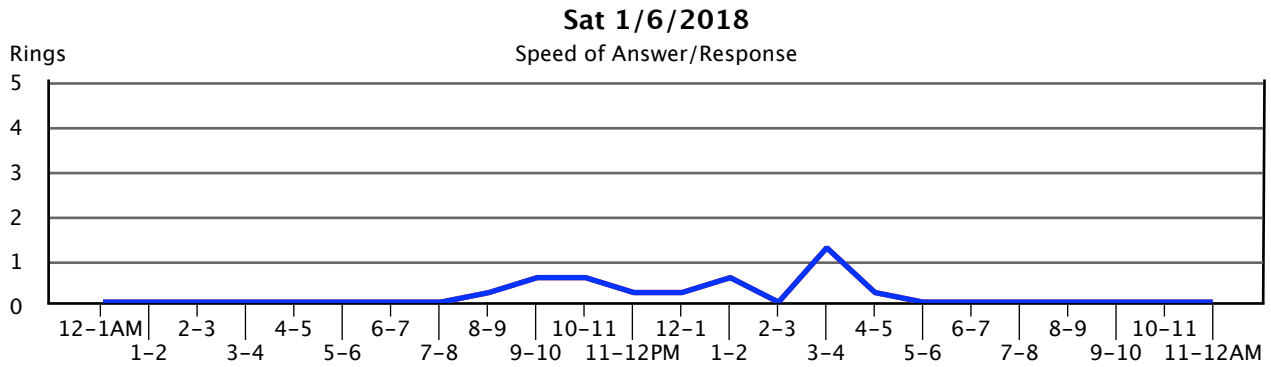
Answer

Response

Wed 1/10/2018

Rings

Speed of Answer/Response

5	
4	
3	
2	
1	
0	

12–1AM   2–3   4–5   6–7   8–9 10–11 12–1 2–3 4–5 6–7 8–9 10–11
    1–2   3–4   5–6   7–8 9–10 11–12PM 1–2 3–4 5–6 7–8 9–10 11–12AM
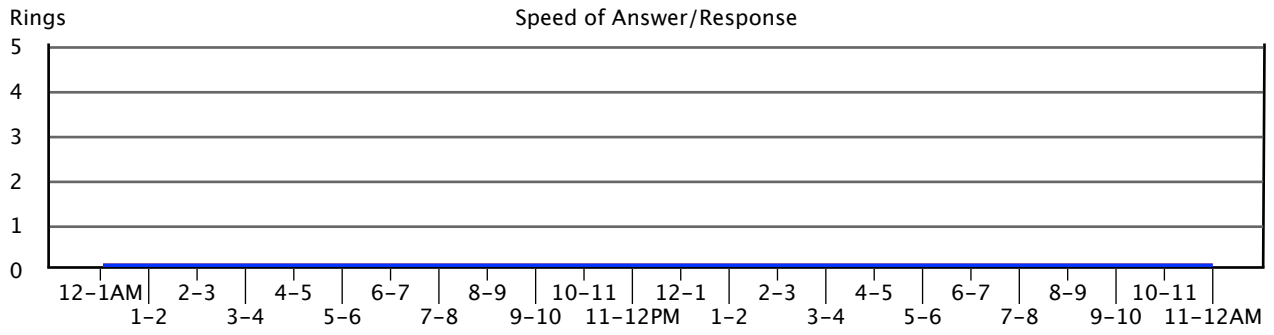
8.3. Delayed Calls (Average Time in Queue)

These graphs show the total number of calls placed in queue waiting for an operator to answer (as shown by the line) and the average amount of time (in number of rings) calls spent waiting for an attendant to answer (as shown by the columns). Calls which abandon before being answered are not included. The scale for the columns is on the left hand side while the scale for the number of delayed calls is on the right.

High queue times may indicate the need to either readjust staffing or add additional attendant positions. Consult Appendix A for Manufacturer norms, and sections 8.2 – "Speed of Answer/Response" and 8.5 – "Console Statistics" to better gauge overall console performance.
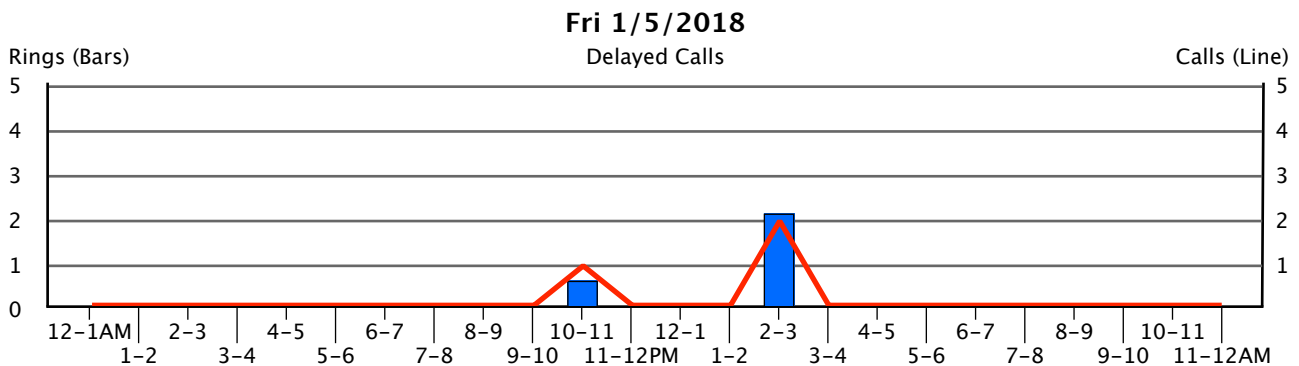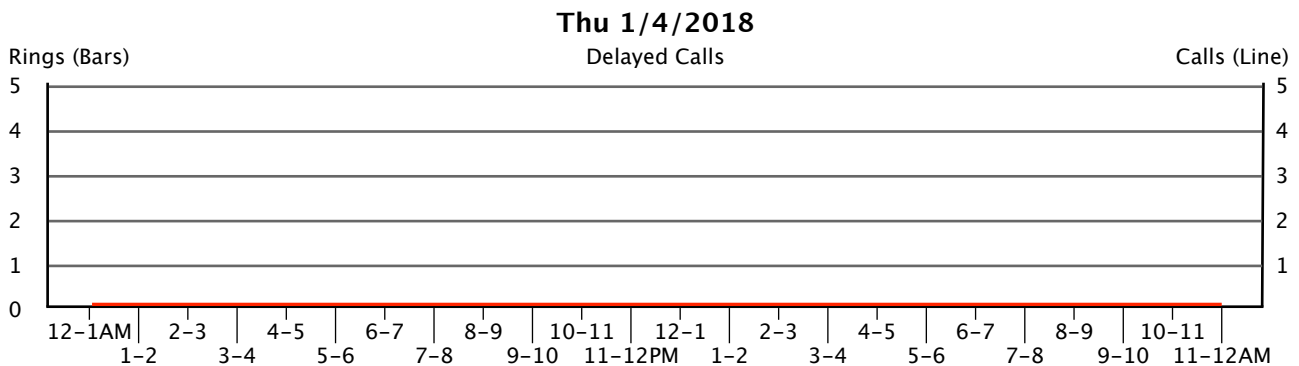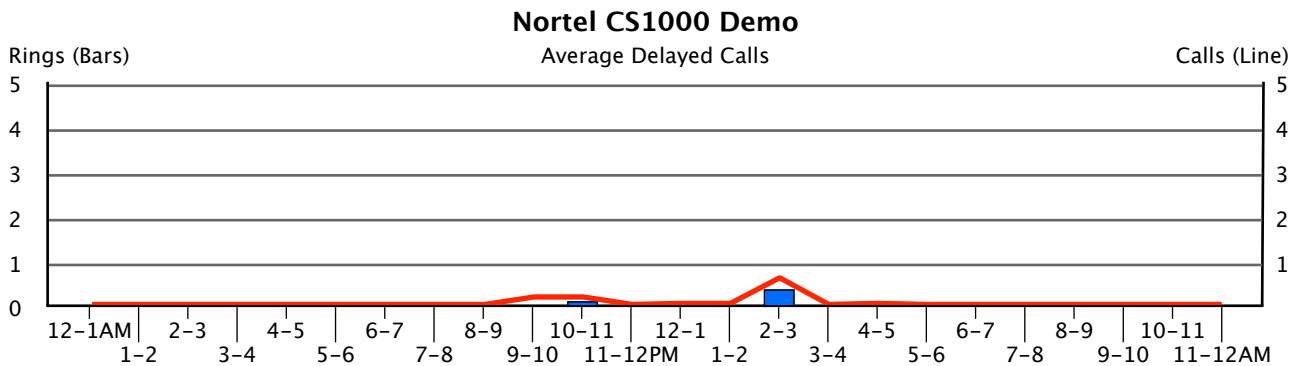
Delay Time   Calls Delayed

Sat 1/6/2018

Rings (Bars)   Delayed Calls   Calls (Line)

Sun 1/7/2018

Rings (Bars)   Delayed Calls   Calls (Line)

Mon 1/8/2018

Rings (Bars)   Delayed Calls   Calls (Line)

Tue 1/9/2018

Rings (Bars)   Delayed Calls   Calls (Line)
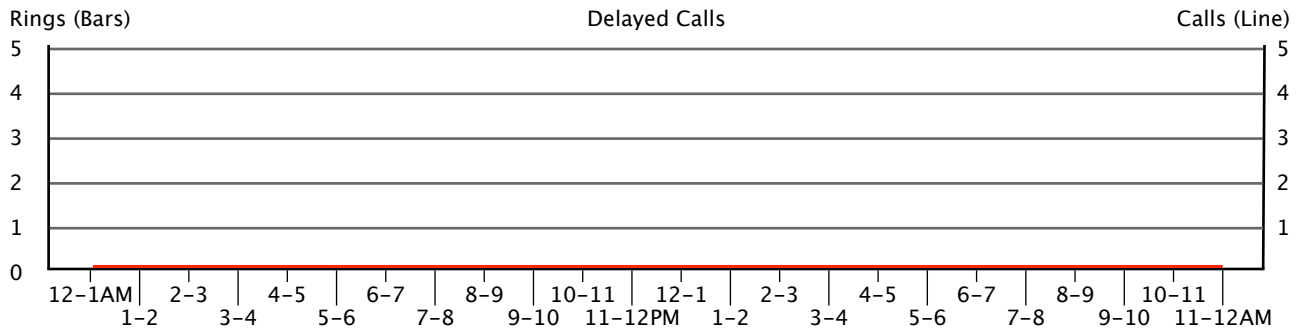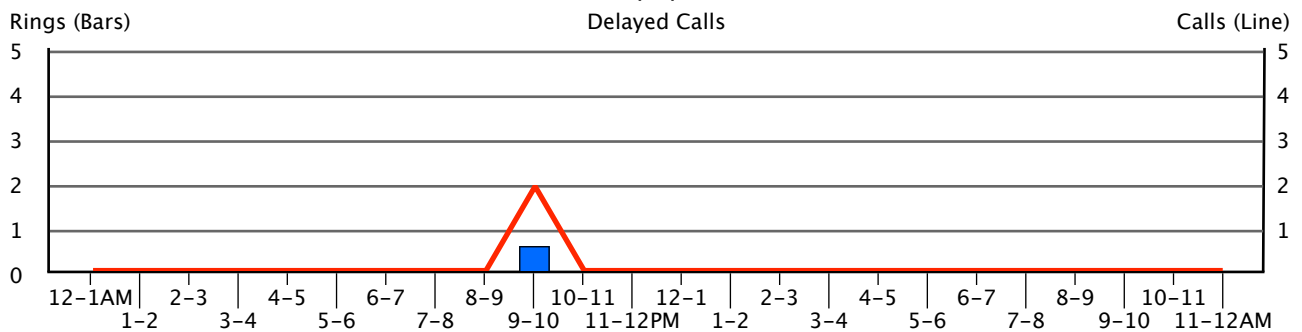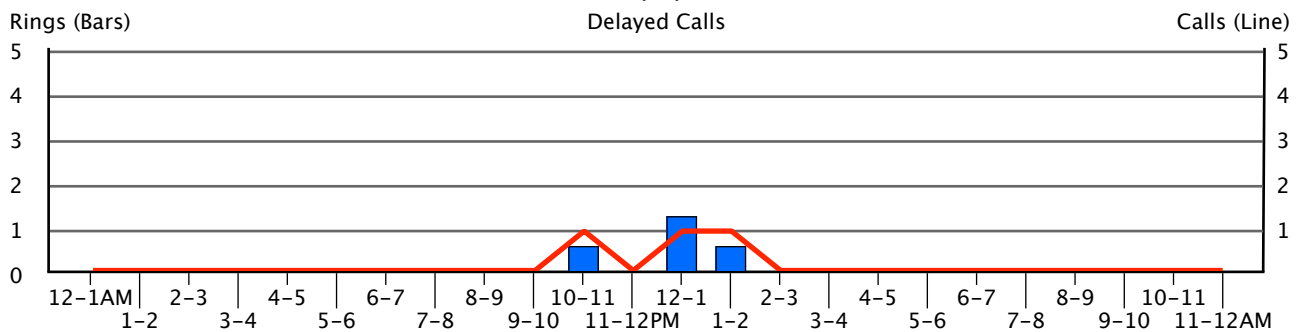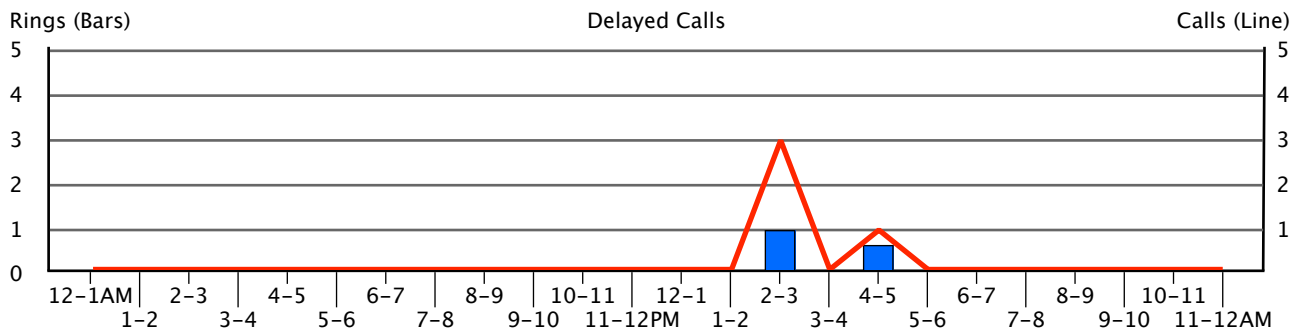
Delay Time   Calls Delayed

Wed 1/10/2018

Rings (Bars)   Delayed Calls   Calls (Line)

| | 12–1AM | 2–3 | 4–5 | 6–7 | 8–9 | 10–11 | 12–1 | 2–3 | 4–5 | 6–7 | 8–9 | 10–11 |
| | 1–2 | 3–4 | 5–6 | 7–8 | 9–10 | 11–12PM | 1–2 | 3–4 | 5–6 | 7–8 | 9–10 | 11–12AM |
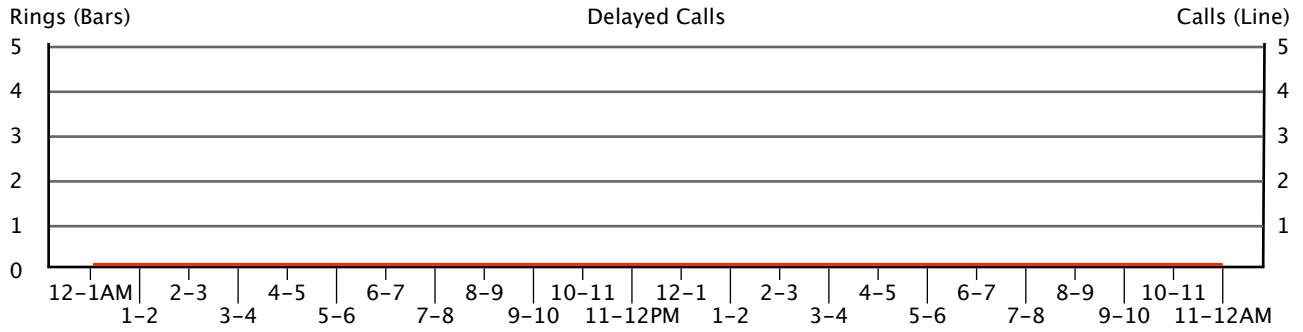
8.4. Abandoned Calls

These graphs show the average amount of time calls spent waiting for an attendant to answer before hanging up (as shown by the columns), and the total number of calls which did abandon (as shown by the line).

We would expect to see a direct correlation between this report and high queue times as shown in section 8.3 – "Delayed Calls". Consult section 8.5 – "Console Statistics" and Appendix A to help gauge console performance.

Nortel CS1000 Demo
Average Abandoned Calls

Thu 1/4/2018
Abandoned Calls

Fri 1/5/2018
Abandoned Calls

Wait Time   Calls Abandoned

Sat 1/6/2018

Rings (Bars)   Abandoned Calls   Calls (Line)

Sun 1/7/2018

Rings (Bars)   Abandoned Calls   Calls (Line)

Mon 1/8/2018

Rings (Bars)   Abandoned Calls   Calls (Line)

Tue 1/9/2018

Rings (Bars)   Abandoned Calls   Calls (Line)

Wait Time   Calls Abandoned

Wed 1/10/2018

Rings (Bars)   Abandoned Calls   Calls (Line)

10	5
8	4
6	3
4	2
2	1
0	

12–1AM   2–3   4–5   6–7   8–9   10–11   12–1   2–3   4–5   6–7   8–9   10–11
    1–2   3–4   5–6   7–8   9–10   11–12PM   1–2   3–4   5–6   7–8   9–10   11–12AM

8.5. Console Statistics

The following table presents some of the raw data that we have displayed graphically in the preceding sections. The data shown here is accumulated for all consoles, and summary information is provided at the end of each day in the study period.

Date	Time	Total Calls Offered	# Calls Answered	# Calls Delayed	% Calls Delayed	Avg Wait (sec.)	# Calls Abnd.	% Calls Abnd.	Avg Wait (sec.)	Loop Busy
Thu 1/4/18	12AM-1AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	1-2AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	2-3AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	3-4AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	4-5AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	5-6AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	6-7AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	7-8AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	8-9AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	9-10AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	10-11AM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	11AM-12PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	12PM-1PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	1-2PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	2-3PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	3-4PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	4-5PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	5-6PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	6-7PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	7-8PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	8-9PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	9-10PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	10-11PM	0	0	0	0	0	0	0	0	0
Thu 1/4/18	11PM-12AM	0	0	0	0	0	0	0	0	0
Daily Totals		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Fri 1/5/18	12AM-1AM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	1-2AM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	2-3AM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	3-4AM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	4-5AM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	5-6AM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	6-7AM	0	0	0	0	0	0	0	0	0

Date	Time	Total Calls Offered	# Calls Answered	# Calls Delayed	% Calls Delayed	Avg Wait (sec.)	# Calls Abnd.	% Calls Abnd.	Avg Wait (sec.)	Loop Busy
Fri 1/5/18	7-8AM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	8-9AM	8	8	0	0	0	0	0	0	0
Fri 1/5/18	9-10AM	9	6	0	0	0	3	33	2.6	0
Fri 1/5/18	10-11AM	6	6	1	17	4	0	0	0	0
Fri 1/5/18	11AM-12PM	1	1	0	0	0	0	0	0	0
Fri 1/5/18	12PM-1PM	4	3	0	0	0	1	25	2	0
Fri 1/5/18	1-2PM	2	2	0	0	0	0	0	0	0
Fri 1/5/18	2-3PM	7	7	2	29	13	0	0	0	0
Fri 1/5/18	3-4PM	3	3	0	0	0	0	0	0	0
Fri 1/5/18	4-5PM	5	5	0	0	0	0	0	0	0
Fri 1/5/18	5-6PM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	6-7PM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	7-8PM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	8-9PM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	9-10PM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	10-11PM	0	0	0	0	0	0	0	0	0
Fri 1/5/18	11PM-12AM	0	0	0	0	0	0	0	0	0
Daily Totals		**45**	**41**	**3**	**7**	**10**	**4**	**9**	**2**	**0**
Sat 1/6/18	12AM-1AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	1-2AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	2-3AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	3-4AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	4-5AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	5-6AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	6-7AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	7-8AM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	8-9AM	1	1	0	0	0	0	0	0	0
Sat 1/6/18	9-10AM	3	3	0	0	0	0	0	0	0
Sat 1/6/18	10-11AM	1	1	0	0	0	0	0	0	0
Sat 1/6/18	11AM-12PM	2	2	0	0	0	0	0	0	0
Sat 1/6/18	12PM-1PM	1	1	0	0	0	0	0	0	0
Sat 1/6/18	1-2PM	1	1	0	0	0	0	0	0	0
Sat 1/6/18	2-3PM	1	1	0	0	0	0	0	0	0
Sat 1/6/18	3-4PM	2	2	0	0	0	0	0	0	0
Sat 1/6/18	4-5PM	2	1	0	0	0	1	50	32	0
Sat 1/6/18	5-6PM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	6-7PM	0	0	0	0	0	0	0	0	0

Date	Time	Total Calls Offered	# Calls Answered	# Calls Delayed	% Calls Delayed	Avg Wait (sec.)	# Calls Abnd.	% Calls Abnd.	Avg Wait (sec.)	Loop Busy
Sat 1/6/18	7-8PM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	8-9PM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	9-10PM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	10-11PM	0	0	0	0	0	0	0	0	0
Sat 1/6/18	11PM-12AM	0	0	0	0	0	0	0	0	0
Daily Totals		**14**	**13**	**0**	**0**	**0**	**1**	**7**	**32**	**0**
Sun 1/7/18	12AM-1AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	1-2AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	2-3AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	3-4AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	4-5AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	5-6AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	6-7AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	7-8AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	8-9AM	2	2	0	0	0	0	0	0	0
Sun 1/7/18	9-10AM	4	4	2	50	4	0	0	0	0
Sun 1/7/18	10-11AM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	11AM-12PM	1	1	0	0	0	0	0	0	0
Sun 1/7/18	12PM-1PM	1	1	0	0	0	0	0	0	0
Sun 1/7/18	1-2PM	1	1	0	0	0	0	0	0	0
Sun 1/7/18	2-3PM	2	2	0	0	0	0	0	0	0
Sun 1/7/18	3-4PM	7	7	0	0	0	0	0	0	0
Sun 1/7/18	4-5PM	2	2	0	0	0	0	0	0	0
Sun 1/7/18	5-6PM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	6-7PM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	7-8PM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	8-9PM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	9-10PM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	10-11PM	0	0	0	0	0	0	0	0	0
Sun 1/7/18	11PM-12AM	0	0	0	0	0	0	0	0	0
Daily Totals		**20**	**20**	**2**	**10**	**4**	**0**	**0**	**0**	**0**
Mon 1/8/18	12AM-1AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	1-2AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	2-3AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	3-4AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	4-5AM	0	0	0	0	0	0	0	0	0

Date	Time	Total Calls Offered	# Calls Answered	# Calls Delayed	% Calls Delayed	Avg Wait (sec.)	# Calls Abnd.	% Calls Abnd.	Avg Wait (sec.)	Loop Busy
Mon 1/8/18	5-6AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	6-7AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	7-8AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	8-9AM	5	5	0	0	0	0	0	0	0
Mon 1/8/18	9-10AM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	10-11AM	4	4	1	25	4	0	0	0	0
Mon 1/8/18	11AM-12PM	4	4	0	0	0	0	0	0	0
Mon 1/8/18	12PM-1PM	4	1	1	100	8	3	75	22	0
Mon 1/8/18	1-2PM	1	1	1	100	4	0	0	0	0
Mon 1/8/18	2-3PM	1	1	0	0	0	0	0	0	0
Mon 1/8/18	3-4PM	7	6	0	0	0	1	14	8	0
Mon 1/8/18	4-5PM	2	2	0	0	0	0	0	0	0
Mon 1/8/18	5-6PM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	6-7PM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	7-8PM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	8-9PM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	9-10PM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	10-11PM	0	0	0	0	0	0	0	0	0
Mon 1/8/18	11PM-12AM	0	0	0	0	0	0	0	0	0
Daily Totals		**28**	**24**	**3**	**13**	**5**	**4**	**14**	**19**	**0**
Tue 1/9/18	12AM-1AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	1-2AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	2-3AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	3-4AM	0	0	0	0	0	0	0	0	Busy
Tue 1/9/18	4-5AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	5-6AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	6-7AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	7-8AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	8-9AM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	9-10AM	3	3	0	0	0	0	0	0	0
Tue 1/9/18	10-11AM	2	2	0	0	0	0	0	0	0
Tue 1/9/18	11AM-12PM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	12PM-1PM	5	5	0	0	0	0	0	0	0
Tue 1/9/18	1-2PM	4	4	0	0	0	0	0	0	0
Tue 1/9/18	2-3PM	7	7	3	43	6	0	0	0	0
Tue 1/9/18	3-4PM	4	4	0	0	0	0	0	0	0
Tue 1/9/18	4-5PM	6	6	1	17	4	0	0	0	0

Date	Time	Total Calls Offered	# Calls Answered	# Calls Delayed	% Calls Delayed	Avg Wait (sec.)	# Calls Abnd.	% Calls Abnd.	Avg Wait (sec.)	Loop Busy
Tue 1/9/18	5-6PM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	6-7PM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	7-8PM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	8-9PM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	9-10PM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	10-11PM	0	0	0	0	0	0	0	0	0
Tue 1/9/18	11PM-12AM	0	0	0	0	0	0	0	0	0
Daily Totals		**31**	**31**	**4**	**13**	**6**	**0**	**0**	**0**	**0**
Wed 1/10/18	12AM-1AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	1-2AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	2-3AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	3-4AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	4-5AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	5-6AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	6-7AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	7-8AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	8-9AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	9-10AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	10-11AM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	11AM-12PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	12PM-1PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	1-2PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	2-3PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	3-4PM	0	0	0	0	0	Abnd.	0	0	Busy
Wed 1/10/18	4-5PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	5-6PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	6-7PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	7-8PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	8-9PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	9-10PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	10-11PM	0	0	0	0	0	0	0	0	0
Wed 1/10/18	11PM-12AM	0	0	0	0	0	0	0	0	0
Daily Totals		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

9. Summary

9.1. Action Items

Following is a summary of issues raised during the processing of this Traffic Study which you may want to take action on. The details of each item and supporting information may be found in the corresponding section of the report. Please note that several of these Action Items are based on standard recommendations and may not be suitable or appropriate for your unique telecommunications environment. Addressing these issues now will lead to better service, fewer user complaints, a better utilization of system resources, and an easier system to manage.

Annual Traffic Studies will help ensure continued good service by performing these evaluations on a regular basis.

Failures to Match

There were a total of **15** Failures to Match experienced during the study period. You may want to consider re-balancing resources across Loops or investigating possible faulty hardware to eliminate this condition.

See Section 4.1, "Failures to Match" for additional details.

Dial Tone Delay

There were a total of **5** distinct hours during the study period in which delays for Dial Tone were encountered. You may want to consider adding DTR cards to your system to eliminate this condition.

See Section 4.2, "Dial Tone Delay" for additional details.

DSP Allocation Failures

The following IP Media Gateways experienced failed DSP allocation attempts during the study period: **3, 5**

You may want to consider adding DSP resources to your system or rebalancing the IP Media Gateways to eliminate this condition.

See Section 4.3, "DSP Resource Blockage" for additional details.

Insufficient Bandwidth Blockage

The following IP Media Gateways experienced blockages due to insufficient bandwidth during the study period: **3**

You may want to consider increasing the bandwidth of these IP Media Gateways or changing your CODEC to eliminate this condition.

See Section 4.4, "Insufficient Bandwidth Blockage" for additional details.

Overtrunked Trunk Groups

The following Trunk Groups have more than enough trunks to carry <u>twice</u> the usage experienced during the busiest hour of the study period at a P.01 Grade of Service: **1, 3**

If the usage encountered during this study period was indicative of future activity, you may want to consider removing trunks from these groups to reduce recurring costs.

See Section 6.1, "Trunk Group Traffic" for additional details.

Insufficient Console Manned Time

91% of the hours during the study collection period did not have at least one console manned for the entire hour. In an attempt to derive the intended business hours of your organization, this analysis only includes hours strictly between the first and last hour of each day that a console was manned. You may want to adjust attendant staffing to ensure continuous console coverage during business hours.

See Section 8.1, "Overlay Graphs" for additional details.

High Console Response Times

16% of the manned console hours during the study collection period had an average Console Response Time which exceeded the manufacturer's most conservative recommendation of 5 seconds. You may want to assess operator workload to ensure Response Times remain low.

See Section 8.2, "Speed of Answer/Response" for additional details.

High Console Abandoned Calls Percentage

There were **5** distinct hours during the study collection period in which the percentage of console calls abandoned exceeded the manufacturer's most conservative recommendation of 5%. You may want to consider increasing console coverage during business hours and/or verifying consoles have appropriate night service coverage during non-business hours to ensure the percentage of calls abandoned remains low.

See Section 8.4, "Abandoned Calls" for additional details.

Appendix A. Typical Busy Hour Data for Attendant Consoles

(as published by Nortel Networks)

	Very Efficient Attd In Non DID system	Avg Attendant In Non DID system	Avg Attendant In DID system
Average Speed of Answer (seconds)	8	10–12	12–15
Average Response Times (seconds)	1–2	2–3	3–5
Calls Delayed	25–35%	25–35%	25–35%
Avg Wait time of Calls in Queue & Abandoned Calls (seconds)	8–10	10–12	12–15
Abandoned Calls	1–2%	1–2%	3–5%
# Calls per Attendant	175–200	150–175	125–150
% Time Manned	95–100%	>85%	>85%
Work Time per Call (seconds)	7–8	10–12	12–16

Appendix B. Viewing your Traffic Study on the Web

Introduction

Every InfoPlus Traffic Study that is run will be automatically archived and uploaded to our web site for secure online viewing. Access to this information is via a password protected login which provides a list of all InfoPlus reports archived for the account, and the dates they were run. We will store every Traffic Study for at least three years, allowing comparison of current statistics with those from previous InfoPlus studies run for that account. Also, this technology allows any number of your people, across town or across the country, to view the data simultaneously and discuss its implications.

Suggested Software

The Traffic Studies will be stored in PDF format, also known as Adobe Acrobat® format. You will need the Adobe Reader® application (version 5.0 or later) and any web browser to view the PDF files. Adobe Reader is free to download from Adobe's web site (www.adobe.com).

Instructions

Upon completion of this report, authorized users will receive a notification email with instructions on how to log in to their account. Depending on the level of access you're granted, you will be able to view and download reports for this system only, or use an enhanced interface for analyzing and downloading reports from multiple systems you manage. Once logged in, you will be presented with a list of all available InfoPlus reports for each system, along with the date each report was run. Select the report you wish to view, and it will either be presented directly in your browser window, downloaded to your computer, or displayed within a new Adobe Reader window. Use the navigation bar to flip through the report page by page, or use the bookmarks on the left to access a particular section.

Appendix C. Hints for Easier Traffic Management

1. If you suspect you have too many trunks in a Trunk Group (either incoming or outgoing) and want to reduce your costs, don't disconnect the trunks at first, but just busy them out. This way, you can wait to see if you receive any complaints. If you receive complaints (or other indications of busies), it's very simple to reactivate one or more trunks without delay or Telco expense. After you are comfortable with the reduced number of trunks, you can then disconnect them without risk.

2. Use the Trunk Group Busy lamps on the console to monitor your Trunk Groups. They will give your operators realtime indications of busy conditions. Make sure they are labeled so that the operators can associate a lamp with a specific Trunk Group. You might ask the operators to keep a simple stroke count every time they notice a Trunk Group Busy lamp light. This will give you an early warning of busy conditions.

3. Outgoing Trunk Groups having more than 2 trunks could be split up into 2 Trunk Groups. The second group would consist of only one trunk, and the first group would overflow to the second. This way, we have the same total number of trunks but we can get a better picture of your traffic from the traffic reports. Also, if both Trunk Groups have busy lamps, as recommended above, the busy lamp on the first Trunk Group serves as a warning lamp. If you use CDR, make sure you reflect these changes in your CDR system.

Glossary

Abandoned Call

A call which voluntarily hung–up before being answered.

ATB (All Trunks Busy)

The number of times during a given hour that all of the Trunks in a Trunk Group were busy. A review of the "Overflow Calls" for that Trunk Group may indicate simultaneous calls in excess of the number of trunks which may, or may not, have been completed. See Overflow Calls.

Bandwidth

The rate at which successive packets of data can be transmitted over an IP network. Bandwidth is measured in kbps (thousands of bits per second), Mbps (millions of bits per second), or Gbps (billions of bits per second).

Bouncing Busy Hour

To project the heaviest traffic for a given period, the Bouncing Busy Hour concept would seek out the heaviest traffic within any given hour regardless of the day in which that hour occurred. For example, in attempting to show the heaviest traffic by hour of the day over a 5 day study, the 9 AM hour might be from Wednesday, while the 10 AM hour might be from Monday.

CCS

A unit of time equal to 100 seconds. To convert CCSs to minutes, multiply by 100, then divide by 60.

CDR

Call Detail Recording - A log of statistics about the calls handled by a Communication Server, including call duration, destination number, date and time, etc.

Codec

An algorithm that encodes and decodes a data stream for transmission over a network or storage to persistent media. In the encoding and decoding process, data compression/decompression techniques can be applied to reduce the apparent amount of data transported by the network or stored.

DSP

Digital Signal Processor - Hardware in the Communication Server that is responsible for translating between IP-based and non-IP-based (TDM) resources.

DTR

A port within the Communication Server which provides the various tones and signals for the system.

Erlang B

A probability formula used for determining trunking requirements for strictly outgoing Trunk Groups, where excess calls are not queued but rather blocked or overflowed.

Erlang C

A probability formula used for determining trunking requirements for incoming or two-way Trunk Groups, where excess calls may be queued.

InterLoop

Traffic between two terminals assigned to two different equipment Loops

IP (Internet Protocol)

A widely adopted protocol for transmitting data across a packet switched network, including the Internet.

IntraLoop

Traffic between two terminals assigned to the same equipment Loop.

Junctor

A Junctor links two Network Groups together such that any terminal in one Network Group may communicate with any other terminal in the other Network Group.

LAN (Local Area Network)

A network that is internal to your organization. A LAN is viewed as a private resource with restricted access.

Loop

A set of equipment within the Communication Server shared by a finite number of terminals, with finite traffic carrying capacity.

Network Group

A Network Group consists of 32 Loops, each with 30 time slots. The maximum size of a Meridian 1 or Communication Server 1000 is eight groups totaling 256 Loops.

Overflow Calls

The number of call attempts presented to a Trunk Group which were blocked due to all of the trunks being busy. If the Trunk Group is part of a Route List, these calls would have been presented to the next Trunk Group in that list. If not part of a Route List, a busy would be returned to the caller.

P.0x

An abbreviation for the specification of a service objective. P.01 indicates a .01 service objective. See Service Objective.

PBX

Private Branch eXchange - A private telephone system which provides connectivity and switching functionality for an organization.

Peg

A simple stroke count of events; in most cases those events are calls.

Poisson

A probability formula used for determining trunking requirements for Trunk Groups in which excess calls may be queued, but maximum holding times are fixed.

Regrade

The reassignment of terminals from one Loop to another to balance traffic between all Loops within the system.

Service Objective

The statistical probability of receiving a busy signal for a given volume of traffic presented to a given number of trunks. For example, a Service Objective of .02 would indicate a sufficient number of trunks such that no more than 2 busies out of a theoretical 100 call attempts would be incurred during a given hour.

Silence Suppression

When encoding voice communications into IP packets, silence is not encoded and transmitted as part of the voice traffic data. This reduces the overall bandwidth requirements on an IP network, and is an optional feature that may be enabled. Silence Suppression is also referred to as VAD (Voice Activity Detection).

SourceBook

A documentation of the assignments and configuration of a Communication Server, taken directly from the system.

Speed of Answer

The average amount of time a delayed call must wait before being answered by an attendant. Speed of Answer is a sum of the time a call spent in queue, plus the Speed of Response.

Speed of Response

The average amount of time a call must wait before being answered by an attendant, once the call was the next available call to be answered. It answers the question, "How quickly does the operator(s) respond to the indication of an incoming call?" High Answer times, but low Response times, may indicate an insufficient number of consoles.

TDM

Time-Division Multiplexing - Refers to the legacy digital and analog technology responsible for transferring signals within a Communication Server before the introduction of IP-based telephony.

Terminal

Any port within the system, usually meant to refer to a station or trunk.

Trunk

A voice and/or data channel between two telecommunications facilities. Trunks connect a private Communication Server to the public telephone network or other private facilities.

Trunk Group

Trunks of similar nature and purpose defined in the system.

VAD (Voice Activity Detection)

When encoding voice communications into IP packets, silence is not encoded and transmitted as part of the voice traffic data. This reduces the overall bandwidth requirements on an IP network, and is an optional feature that may be enabled. VAD is also referred to as Silence Suppression.

VoIP (Voice over IP)

The transmission of voice communications over IP networks. Speech is encoded into IP packets using a codec, and transmitted over an IP network instead of a conventional, dedicated telecommunications network. The IP network may simultaneously be carrying non-voice data as well, resulting in a Converged Network.

WAN (Wide Area Network)

A network covering a broad geographical area. A WAN is typically viewed as a network that is external to your organization, and may be public or private.