Traffic

Module 7

Traffic

Intentionally
Blank

Traffic, Measurements, and Reports

OVERVIEW

Well, this is it, the last "real" module in this course. By now, your foundation in system hardware and software should be strong enough to allow you to talk intelligently with almost any SL-1 user. Unless the SL-1 user wants to talk about the efficiency of their individual switch, "Am I utilizing my SL-1 properly? Can I add 43 more sets in the new office space? Why do I get phone system complaints in the late afternoon? I get all of these "nifty" reports, but I don't understand them."

These questions are always in the minds of the managers responsible for insuring the SL-1 is cost and time effective. You see, almost everything you have been exposed to so far in this course is taken for granted by a customer that has been using an SL-1 for a few months. They take all of the information about hardware, software and features for granted. What they want to know is the "status" of things.

This is where traffic enters the picture. As you have probably surmised, traffic is a term describing the utilization of the switch. In other words, traffic is the methodology that describes actual handling or processing of all calls by the system. It is important to remember that Traffic is a theory based in the mathematics of statistics. Traffic Engineering is a science that relies on averages and estimates for problem solution.

Traffic

Traffic is primarily used in monitoring switch performance, identifying potential congestion problems, and as an aid in planning efficient use of, or future use (growth) of, a system.

There are five facets to traffic data collection in the SL-1: accumulation; holding; printing; control; and outputting.

Accumulation describes the function of gathering the information then storing it for later use. Let's describe one of the items of information that will be collected in the accumulation stage.

> Whenever any network path is seized, the time of day is stored in a register (a small memory section) associated with that network path. When the path is later idled, the previously stored time is subtracted from the current time to determine "path usage". That usage figure is moved and combined with another register that contains an accumulation of the time on that network.

Holding is the process of maintaining all of the "total usage" data. The transfer of data from the accumulating registers to the holding registers is performed according to user-defined time schedules. There is one holding register for every accumulating register. The information in the holding registers is available for examination or printing at any time.

Certain traffic measurements have an advisory threshold associated with them. These thresholds are generally peg counts that are associated with a specific event. During the transfer of data between the accumulating registers to the holding registers, these thresholds are compared with the data. If a threshold is exceeded, a special message is printed on the system terminal. This message also contains blocks of data relevant to the threshold.

Printing. When data is being transferred between registers, there are printing options that allow given blocks of data to be printed immediately. This is exclusive of threshold print-outs. There is also software, called the Traffic Control Overlay Program, that permits blocks of data to be printed on demand.

Control refers to setting the thresholds, schedules, printing options, or any other traffic oriented parameters. This is accomplished by using the Traffic Control Overlay Program.

Outputting is just that, getting the data to a printer (TTY) for analysis. You will see the result of outputting later in this Module.

Now let's take a closer look at the terminology and standards used in traffic measurement.

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TERMINOLOGY

Just like any specific field of interest, traffic engineering has its own vocabulary or "buzz words". We had better start out by introducing you to some of those words. Now don't get us wrong, we're not expecting you to become traffic engineers, but you will be surprised by how many people in telecommunications are very adept in "talking the language".

CCS

Traffic is measured in CCSs rather than seconds or minutes. CCS stands for Hundred (Century) Call Seconds. "C" is the math symbol for 100

CS = call seconds
CCS = 100 call seconds
1 CCS = 100 seconds
36 CCS = 1 hour

This is your last time to get it, ready?

For 1 hour:

$$\frac{(60 \text{ minutes} \times 60 \text{ seconds})}{100} = \frac{3600}{100} = 36 \text{ CCS}$$

$$\frac{(\text{minutes} \times 60) + \text{seconds}}{100} = \text{Number of CCS}$$

Example: A 3 min., 23 second conversation

$$\frac{(3 \times 60) + 23}{100} = \frac{180 + 23}{100} = 2.03 \text{ CCS}$$

Traffic

We mentioned earlier that we're measuring traffic. Let's look at what devices generate traffic and how much they generate.

All Peripheral Equipment terminations generate traffic. The traffic they generate is expressed in terms of "CCS per hour". An estimated average for a typical business might be:

Device	Traffic Generated
SL-1 sets	6 CCS/hr.
500/2500 sets	6 CCS/hr.
Trunks	20 CCS/hr.
Paging Trunks	4 CCS/hr.
Consoles	30 CCS/hr.

There is one other P.E. card type that generates traffic, the Digitone Receiver. Charts must be used to figure how much traffic they generate.

Keep in mind the figures we have given you are average figures and may not represent the CCSs required in your system. A set that was busy for one hour generates 36 CCS. A terminal involved in data transmission eight hours a day will generate 36 CCS of traffic each hour. In a hotel, the sets located in the rooms are probably idle most of the day and probably generate an average of 1 to 2 CCS.

Network Traffic Capacity

Each network loop is capable of carrying up to 600 CCS of combined station, trunk, console, and Digitone traffic. This figure is for the average Busy Season, Busy Hour traffic at approximately P.01 grade of service *. This figure is true for the SL-1LE, VLE, XL and M switch types.

The SL-1N and XN switches carry up to 660 CCS per network loop and have the same approximate grade of service and the other systems. This increase is due to the removal of the "matching timeslot" constraint.

For more information detailing grade of service restrictions, see NTP section 553-2001-151.

Now that we mentioned "grade of service" we'd better discuss that further.

During the installation phases of an SL-1, all prospective SL-1 users are asked about their traffic on a day to day, and month to month, etc., period of time. Particular attention is paid to the "normal" busy time period. The reason being, that it is foolhearty to buy equipment that is going to sit idle waiting for a "worst case" condition to occur.

* See the following page (Grade of Service) for the assumptions used to derive the 600 and 660 CCS figures.

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Grade of Service

Grade of Service is a statistical term that describes the success rate of placing or receiving a call. The following are the assumptions used to determine SL-1 Grade of Service figures.

- The loss of no more than 1 percent of the incoming terminating calls, provided the called line is free.
- The loss of no more than 1 percent of the originating outgoing calls in the system, provided an idle trunk is available.
- The loss of no more than 4 percent of the intra-office calls, provided the called line is free.
- No more than 1.5 percent of the originating calls wait longer than 3 seconds for a dial tone.
- The loss of no more than 1 percent of tandem calls, provided an idle outgoing trunk is available.

The level of the Grade of Service is called out by using the letter "P", followed by a decimal number, generally ".01". The "P" represents Probability, and the number is the decimal equivalent of the percentage of calls failing to seize a time slot, etc. One failed seizure in a hundred attempts is represented as P.01, one in a thousand is P.001, and so on.

Erlang and Poisson

Traffic measurement and engineering is performed in a statistical method that uses "Erlangs" or "Poisson" as the unit of description. At this point it suffices to say that Erlang is a measurement method that measures "calls connected", and Poisson measures all "attempts at call connection". The two methods of describing traffic accumulation are both represented in charts located in the NTPs. These charts allow the traffic engineer to work in the system he/she is familiar with.

Blocking

One final concept before we leave the "statistics" area. There is a term that is used to describe the inability to seize a timeslot. That term is "blocking". Blocking occurs when the demand for service exceeds the ability of the system to provide timeslots for a service request. Blocking is also included in the mathematical models used to describe a switch's environment.

The SL-1 can be configured to be non-blocking within a network group. By assigning 30 or less terminations per network loop in an SL-1N or XN, one will always be assured of having access to a time slot or talk path. We referred to this as "Flexible Grade of Service" when we discussed network loops.

One final concept before we examine some representative traffic reports generated by a properly equipped SL-1:

Balancing

Balancing is the process of insuring the traffic handled by the switch is distributed evenly over the network loops. An example should demonstrate the importance of balancing.

If a company had both "outside sales" and the personnel department (traditionally high users) on the same loop, the chances for blocking would be extremely high. Whereas, if personnel shared a loop with the maintenance department (traditionally low user), blocking would be extremely rare. This type of load distribution is paramount in providing the SL-1 user with a Grade of Service level that is meaningful.

TRAFFIC REPORTS

At this point, it's time to look at some of the traffic reports that are available to an SL-1 user. As you will see in the reports, there is a terrific amount of information that can be gleaned from the data presented.

A final note: The information presented on the reports is for example only. In no way does it represent actual data from a "real" customer. Also, the headings that are printed on the sample reports are not actually printed on the system generated reports.

NETWORK TRAFFIC
TFS001

This is a one hour block of data system schedule report. There are eight columns of data printed on this report. Remember, we said the actual column headings are not printed on the report. In the samples shown, you will see "FORMAT:" called out. This is a guide for you that shows the heading names for the data on the report. "EXAMPLE:" represents the actual data on the print-out.

TFS001 NETWORKS - FORMAT AND EXAMPLE

FORMAT:

System ID TFS001

Loop Number	Loop Type	Intra FTM	Intra CCS	Intra PC	Loop FTM	Loop CCS	Loop PC

EXAMPLE:

200 TFS001

00	TERM	00000	0000006	00004	00000	0000064	00056
01	TERM	00000	0000035	00022	00000	0000123	00086
02	TERM	00000	0000031	00020	00000	0000126	00075
05	CONF	00000	0000000	00000	00000	0000000	00000
07	TDS	00000	0000000	00000	00000	0000000	00000
08	TERM	00000	0000019	00011	00000	0000143	00098
09	TERM	00001	0000089	00066	00002	0000194	00149
13	TERM	00000	0000000	00000	00000	0000025	00006
15	TDS	00000	0000000	00000	00000	0000031	01496

Note: In Generic X11, the loop number is expressed as a 3-digit number.

TFS001 (contd.)

Loop Number - each loop in the system has its own line of data.

Loop Type - there are four types of network loops:

TERM(inal) - a loop containing lines, trunks, etc. (voice)

TDS - a loop providing tones and DTMF or dial pulse outpulsing. (Tone and Digit Switch).

MF(Sender) - a loop that provides multi-frequency outpulsing.

CONF(erence) - a conference network loop.

Intra FTM - intra loop (calling within that loop) failure to match time slots; incremented once for each blocked attempt.

Intra CCS - usage within the loop for the hour.

Intra PC - incremented once for each intra-loop path completed (matched).

Loop FTM, Loop CCS, and Loop PC are data areas that represent the same information as the intra-loop data except they are an accumulation for both inter-loop (between loops) and intra-loop (same loop) traffic. Example, an "Intra-Loop" peg count will be two peg counts in the "Inter-Loop" columns because two terminals were used.

TRUNK TRAFFIC
TFC002

This is a one hour block of data for a specific customer schedule report. There are two columns of data printed on this report and up to 11 sections (one for each trunk type). Remember we said the actual column headings were not printed on the report. In the samples shown, you will see "FORMAT:" called out. This is a guide for you that shows the heading names for the data on the report. "EXAMPLE:" represents the actual data on the print-out. In this example, only one trunk type is represented (CO - Central Office); all other types have the same format of information.

TFC002 TRUNKS - FORMAT AND EXAMPLE

FORMAT:

System ID TFC002

Customer Number

Group Number — Trunk Type

Trunks Equipped — Trunks Working

Incoming Usage — Incoming PC
Outgoing Usage — Outgoing PC
Outgoing Overflow — All Trunks Busy
Toll PC

EXAMPLE:

200 TFC002

07

004 CO

00008 00007

0000051 00043
0000004 00004
00000 00000
00006

Note: In Generic XII, the customer number is expressed as a 3-digit number.

TFC002 (contd.)

This report consists of incoming and outgoing CCS and peg count, for each trunk group. It also contains information regarding the status of the trunks and the amount of blockage etc.

Customer Number - a number assigned to the individual customers in a single system.

Group Number - the trunk group number.

Trunk Type - one of 11 trunk types:

Wats lines (WATS)
Foreign Exchange (FEX)
Common Controlled Switch Arrangement (CCSA)
Direct Inward Dialing (DID)
Central Office (CO)
Tie trunks (TIE)
Paging trunks (PAGE)
Dictation trunks (DICT)
Recorded Announcement trunks (RAN)
Automatic Identification of Outgoing Dialing (AIOD)
Centralized Automatic Message Accounting (CAMA)

Trunks Equipped - the number of trunks configured in the route at the current time.

Trunks Working - the number of working trunks.

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TCF002 (contd.)

Incoming Usage - CCS for trunk type.

Incoming PC - a peg count for each trunk used.

Outgoing Usage - CCS for trunk type.

Outgoing PC - a peg count for each trunk used.

Outgoing Overflow - a count of the number of times a request for a trunk group occurs when all trunks are busy.

All Trunks Busy - only valid for trunks with more than one equipped member; incremented whenever the last enabled trunk of the group is made busy.

Toll PC - a count of the number of times a toll call was dialed on the route ("0" or "1" is dialed as the first or second digit after the access code).

QUEUE TRAFFIC (Attendant Console)
TFC003

This is a one hour block of data from a customer schedule report. There are two columns of data printed on this report. Remember, we said the actual column headings were not printed on the report. In the samples shown, you will see "FORMAT:" called out. This is a guide for you that shows the heading names for the data on the report. "EXAMPLE:" represents the actual data on the print-out.

TFC003 QUEUE - FORMAT AND EXAMPLE

FORMAT:

System ID TFC003

Customer Number

(Avg. Speed of Answer)
(PC of Calls Delayed)
(PC of Abandoned Calls)

(Avg. Attendant Response)
(Avg. Time in Queue)
(Avg. Wait Time of Abandoned Calls)

EXAMPLE:

200 TFC003

03

00092	00048
00006	00129
00003	00135

Note: In Generic X11, the customer number is expressed as a 3-digit number.

TFC003 (contd.)

NOTE: Time on this report is accumulated in units of two seconds. The reported time is in tenths of a second. This time is provided as an average, so if the sample is small the accuracy suffers.

Customer Number - a number assigned to the individual customers in a single system.

Avg. Speed of Answer - an average of the time all calls waited once they were placed in queue, until they were answered.

Avg. Attendant Response - the average time elapsed between a call being presented to the console and that call being answered; if the attendant answers a different call, via the ICI keys, the time accumulates.

PC of Calls Delayed - incremented whenever a call is removed from the queue.

Average Time in Queue - an average of the amount of time all calls spend waiting to be removed from the queue.

PC of Abandoned Calls - a count of calls that were abandoned before being answered by the attendant.

Average Wait Time of Abandoned Calls - the average amount of time the abandoned calls waited before abandoning.

CONSOLE TRAFFIC
TFC004

This is a one hour block of data from a customer schedule report. There are two columns of data printed on this report. There is also a section of this report for every attendant console assigned to a specific customer. Remember, we said the actual column headings were not printed on the report. In the samples shown, you will see "FORMAT:" called out. This is a guide for you that shows the heading names for the data on the report. "EXAMPLE:" represents the actual data on the print-out.

TFC004 CONSOLE - FORMAT AND EXAMPLE

FORMAT:

System ID TFC004

Customer Number

(PC of Internally Originated Calls Handled by Attendant)
(PC of Externally Originated Calls Handled by Attendant)
(Total Time Console is Manned)
(Number of Times all Attendant Loops are Busy)

(Total Time Spent Servicing Internal Requests)
(Total Time Spent Servicing External Requests)
(Total Time Spent Servicing Calls)

EXAMPLE:

200 TFC004

00

02

00008	0000002
00025	0000004
0000015	0000005
00000	

Note: In Generic X11, the customer number and attendant number are expressed as 3-digit numbers.

TFC004 (contd.)

PC of Internally Originated Calls Handled by Attendant - a count of the number of calls when an attendant releases a call; attendant originated calls are also counted.

Total Time Spent Servicing Internal Requests - the amount of time, in CCSs, an attendant has calls that originated within the SL-1 system, active on the console; internal and outgoing calls are counted.

PC of Externally Originated Calls Handled by Attendant - a count of the number of calls answered by the attendant; counted when the attendant releases the call.

Total Time Spent Servicing External Requests - the amount of time, in CCSs, an attendant has calls that originated outside of the SL-1 system, active on the console (Incoming calls).

Total Time Console is Manned - the total time, in CCSs, the console was not in "Position Busy" or "Night Service".

Total Time Spent Servicing Calls - the total CCSs of both internal and external servicing requests.

Number of Times all Attendant Loops are Busy - this count is incremented whenever the last attendant loop is made busy.

Traffic

There is an entire section in Book 1 of the NTP's devoted to Traffic Measurement. Please refer to that section for a full explanation of all of the traffic reports available. The NTP reference number is 553-2001-450.

As you can see, traffic reports tell you a great deal about both the system and the personnel that operate. Be sure to understand any unusual circumstances in the reports before applying that information to the performance of an individual.

Easy section - no quiz. In fact, you already took your last quiz. So, see you in the Wrap-up Module, Module 8.