A Technical Report of the
Networking and Distributed Systems Laboratory

KU-PNNI Simulator
Version 2.0 Upgrades

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Chapter 1

Introduction

This report describes the status of the KU PNII simulation tool. It briefly states the changes made to the simulator both in the user interface as well as the simulator itself. It also describes the enhancements made to the simulator to support multiple call types per host and the capability to generate different type of calls with different distributions.

Chapter 2 talks about the changes made to the simulator with respect to the user interface and the and the format of how the results are printed. Chapter 3 provides a brief description of the capabilities added to the simulator.

Chapter 4 explains the various bugs that were encountered and fixed and other inconsistencies which were rectified.

Several example scripts and the outputs produced from them are detailed in Chapter 5.
Chapter 2

Amendments

This section details the various changes made to the simulator with respect to the user-interface and the format of the results. Some of the changes made in the user-interface were driven by the need to reduce the size of the input scripts and others resulted to support the new features added to the simulator as described in Chapter3.

2.1 List of Amendments

Here we list the components changed in the simulator.

- **Distributions:** In version 2.0 of the simulator, the distribution for parameters such as arrival rates of calls, duration of calls could be specified as a uniform distribution or poisson distribution or a fixed distribution. In version 2.1, instead of referring a exponential distribution as poisson we refer it as exponential. Thus any parameter declared with the keyword poisson will now be replaced with the keyword exponential. An example of a declaration in the version 2.0 and a corresponding declaration in the version 2.1 is shown below:

  *Exponential Distribution declaration in KU PNNI version 2.0:*

  ```
  arrival_distribution = poisson
  arrival_mean = 20
  ```

  *Exponential Distribution declaration in KU PNNI version 2.1:*

  ```
  arrival_distribution = [exponential 20]
  ```

  The example above indicates that to declare an exponential distribution, we needed two declarations in the version 2.0. One declaration to specify the distribution(i.e. poisson) and the other to specify the parameters of that distribution(i.e. mean). In version 2.1, we can declare the distribution in a single line. This has been done for all distributions, namely, fixed, exponential and uniform. A histogram distribution which is a newly added feature and discussed in Chapter3 should be declared as a block. The examples of histograms will be given in Chapter3.

  We now show, with an example of a duration distribution, how the declarations in the version 2.0 and version 2.1 of the KU PNNI simulator vary:

  **Fixed Distribution**

  *Version 2.0:*

  ```
duration_distribution = fixed
duration_period = 20

Version 2.1:

duration_distribution = [fixed 20]

Uniform Distribution

Version 2.0:

duration_distribution = Uniform
duration_low = 20
duration_high = 50

Version 2.1:

duration_distribution = [Uniform 20 40]

- **Call Bandwidths:** In version 2.0 of the KU PNNI simulator the bandwidth of a call was specified by the parameter `call_bw`. A CBR call is characterised by the peak cell rate, etc. Similarly a VBR call is characterised by peak cell rate, sustainable cell rate, maximum burst size, etc... Since we have added the capability to specify multiple call types in a single host (refer Chapter3) and also the capacity to specify the QoS parameters in terms of distributions, we decided that the parameters of the calls should be specified in more realistic terms. In version 2.1 of the simulator, a CBR call may be specified by a peak cell rate and QoS parameters such as cell transfer delay etc.. Thus `call_bw` cannot be used to specify the bandwidth of a call. Instead parameters such as `pcr` and `pcr2scr` must be used. For a cbr call, `pcr` is a required parameter and `pcr2scr` **must not** be specified. For a vbr call, both `pcr` and `pcr2scr` are required.

We illustrate with an example how a cbr and a vbr call can be declared for a single source. Extensive examples will be given in Chapter5.

**Example for a cbr call:**

call_type = cbr,
PCR = [uniform 10]

**Example for a vbr call:**

call_type = vbr,
PCR = [fixed 100],
PCR2SCR = [uniform 2 10]

Note that `PCR2SCR` does not support an exponential distribution and such a distribution must not be used.

- **Format of Results:** The results printed in version 2.1 of simulator include the `pcr`, the `pcr2scr` ratio and other QoS parameters used for each and every call. In version 2.0 of the simulator the parameters of a call were all constants and thus there was no need to print these results. Since the QoS values can vary for each call, it is necessary to print the results of each call and hence this feature was incorporated in the simulator.

An example output of a simulation is included in Chapter5
Chapter 3

Enhancements

In this section we describe the enhancements made to the simulator. In KUPNNI Version 1.2, a host could generate only a single type of call. Moreover the QoS parameters of the calls were fixed values that the user could specify in the input script. In Version 1.3 of the simulator a single host can generate multiple types of calls with different distributions. For example, a host can generate vbr and cbr calls with a uniform distribution and also specify the cell transfer delay to be uniformly distributed between certain values.

The user can also specify the arrival distributions, duration distributions, and other parameters of a call in terms of a histogram. Specific details are provided in the next section.

Before the user specifies various parameters for multiple sources, the `sourcetype` option and the `numsources` option in the parameter block host must be specified. This informs the simulator that multiple sources will be specified and the number of sources that will be specified. Failure to do this will generate errors.

Multiple source option could be overridden in the the individual host blocks (see Chapter 5). Moreover, all the options for individual sources can also be changed. But if the number of sources are changed by using the `numsources` option in the host block, then all the parameters for each source must be specified again in that host block. For example, if two sources are specified in the parameter block and three sources are specified in the host block then all the parameters of each source in the host block must be stated again irrespective of the parameters specified in the parameter block.

3.1 Component Specific Details

Below is a list of parameters which have been added to support the enhancements.
**parameter:** calltype (followed by the source number for multiple sources)

**description:** This is the service type of the call to be attempted by the source identified by the source number

**values:** cbr for constant bit rate service, abr for available bit rate service, rtvbr for real time variable bit rate service, vbr for non real time variable bit rate service, or unbr for unspecified bit rate service

**default:** cbr

**optional:** Yes

**example:**
For a single source:
```plaintext
calltype = cbr
```
For multiple sources:
```plaintext
calltype1 = cbr,
calltype2 = vbr
```
```
```

**parameter:** arrival distribution

**description:** The distribution of call inter-arrival times in seconds

**values:** periodic, exponential, bursty, tear down and histogram. The user could specify the distributions and the its parameters in a single line or in multiple lines. If the distribution is a histogram then the user will use the histogram option separately to specify its parameters [fixed <value>] or [exponential <mean>] or [uniform <low> <high>] or histogram

**default:** [fixed 10]

**optional:** Yes

**example:**
```plaintext
arrival,distribution = [fixed 10]
```

**parameter:** duration distribution (followed by the source number for multiple sources)

**description:** The distribution of call durations in seconds

**values:** [fixed <value>] or [exponential <mean>] or [uniform <low> <high>] or histogram

**default:** [fixed 1]

**optional:** Yes

**example:**
For a single source:
```plaintext
duration,distribution = [exponential 1]
```
For multiple sources:
```plaintext
duration,distribution1 = [exponential 1],
duration,distribution2 = [fixed 5]
```
```
```
**parameter:** \( \text{pcr} \) (followed by the source number for multiple sources)  
**description:** The distribution of peak cell rates of calls in kbps  
**values:** [fixed <value>] or [exponential <mean>] or [uniform <low> <high>] or histogram  
**default:** [fixed 64]  
**optional:** Yes  
**example:** For a single source:  
\[
\text{pcr} = [\text{exponential} \ 1]
\]  
For multiple sources:  
\[
\text{pcr1} = [\text{exponential} \ 1],
\text{pcr2} = [\text{uniform} \ 20 \ 30]
\]  
etc..  

**parameter:** \( \text{pcr2scr} \) (followed by the source number for multiple sources)  
**description:** The distribution of peak cell rate to sustainable rate ratio. This has no units. All possible values must be 1 or greater  
**values:** [fixed <value>] or [uniform <low> <high>] or histogram. This parameter does not have an exponential distribution  
**default:** [fixed 1]  
**optional:** Yes  
**example:** For a single source:  
\[
\text{pcr2scr} = [\text{uniform} \ 5 \ 10]
\]  
For multiple sources:  
\[
\text{pcr2scr1} = [\text{uniform} \ 5 \ 10],
\text{pcr2scr2} = [\text{fixed} \ 2]
\]  
etc..  

**parameter:** \( \text{mbs} \) (followed by the source number for multiple sources)  
**description:** The distribution of maximum burst size of calls in kilo bytes  
**values:** [fixed <value>] or [exponential <mean>] or [uniform <low> <high>] or histogram  
**default:** None  
**optional:** Yes  
**example:** For a single source:  
\[
\text{mbs} = [\text{fixed} \ 1]
\]  
For multiple sources:  
\[
\text{mbs1} = [\text{fixed} \ 1],
\text{mbs2} = [\text{fixed} \ 5]
\]  
etc..
**parameter:**  \texttt{ctd}(followed by the source number for multiple sources)

**description:**  The distribution of cell transfer delay of calls. The values are in milliseconds

**values:**  [fixed <value>] or [exponential <mean>] or [uniform <low> <high>] or histogram

**default:**  None

**optional:**  No

**example:**  For a single source:  
\[
\text{ctd} = \text{[fixed 1]}
\]

For multiple sources:
\[
\begin{align*}
\text{ctd1} &= \text{[fixed 1]}, \\
\text{ctd2} &= \text{[uniform 1 4]}
\end{align*}
\]

etc..

**parameter:**  \texttt{cdv}(followed by the source number for multiple sources)

**description:**  The distribution of cell delay variation of calls. The values are in milliseconds

**values:**  [fixed <value>] or [exponential <mean>] or [uniform <low> <high>] or histogram. The values specified are in milliseconds.

**default:**  None

**optional:**  Yes

**example:**  For a single source:  
\[
\text{cdv} = \text{[fixed 1]}
\]

For multiple sources:
\[
\begin{align*}
\text{cdv1} &= \text{[fixed 1]}, \\
\text{cdv2} &= \text{[fixed 1]}
\end{align*}
\]

etc..

**parameter:**  \texttt{clr}(followed by the source number for multiple sources)

**description:**  The distribution of cell loss ratio of calls. The values specified are non-negative integers. (The cell ratio is \(10^{(-\text{sampled value from the distribution})}\)).

**values:**  [fixed <value>] or [exponential <mean>] or [uniform <low> <high>] or histogram

**default:**  None

**optional:**  Yes

**example:**  For a single source:  
\[
\text{clr} = \text{[fixed 1]}
\]

For multiple sources:
\[
\begin{align*}
\text{clr1} &= \text{[fixed 1]}, \\
\text{clr2} &= \text{[uniform 1 5]}
\end{align*}
\]

etc..

### 3.1.1 Specifying Histograms

In this section we specify how to use the histogram distribution in the simulator. The histogram distribution can be used for arrival distributions, duration distributions, peak cell rate distributions, peak cell rate to sustainable cell rate ratio distributions, maximum burst size distributions, cell transfer delay distributions, cell delay variation distributions and cell loss ratio distributions.

The histogram has to be specified as a block information and within the parameter block host.
Histogram distribution needs the number of bins, width of each bin, the low limit of the first bin and the percentage share in each bin. The percentage shares must add up to 100 else an error message is generated.

Note: There are no default values for a histogram. All the values of a histogram i.e., bins, binwidth, lowlimit and shares must be specified. Failure to do this would cause the simulation to stop.

Parameter block for histogram

histogram_dist entityname {
  bins
  binwidth
  lowlimit
  shares
}

entityname above could be any of the following:
  harrival, hduration, hpcr, hpcr2ser, hctd, hcdnv, and hch. The 'h' appended to all the attributes (i.e. the 'h' in 'harrival') signifies that it is a histogram and is necessary.

3.1.2 Component Specific details of the histogram block

parameter: bins
description: This is the number of bins in the histogram
values: Non-negative integer value
default: None
optional: No
example: bins = 4

parameter: binwidth
description: This is the width of the bins in the histogram
values: Non-negative real number
default: None
optional: No
example: binwidth = 25

parameter: lowlimit
description: This is the low-level of the first bin in the histogram
values: Non-negative real number
default: None
optional: No
example: lowlimit = 0

parameter: shares
description: This is the share of each bin in percentage
values: [Non-negative real number for each bin adding to 100]
default: None
optional: No
example: shares = [10 40 30 20]
A simple example of a histogram block for a duration distribution in case of a single source is shown below:

```
histogram_dist hduration {
    bins = 2,
    binwidth = 5,
    lowlimit = 5,
    shares = [ 50 50]
}
```

For multiple sources the number of the source is appended to the histogram_dist. For example:

```
histogram_dist1 hduration {
    bins = 2,
    binwidth = 5,
    lowlimit = 5,
    shares = [ 50 50]
}
```
Chapter 4

BugFixes

This section describes the bugs that were encountered while testing the simulator with various test scripts and the files that were modified to correct them. It is advised to refer to the inline commenting provided in the source files.

4.1 List of BugFixes

Here we list a few of the errors which we debugged and rectified in the simulator. A few of the errors were very difficult to trace and consumed a unexpected amount of time. This work was done in co-operation with Pradeep Kumar Mani, (mpradeep@iltc.ku.edu)

- **Timer 308:** Under heavy loads (high call arrival rates), we found that the simulations after running for a long timer suddenly crashed. After days of debugging we found that the expiry of timer 308 was causing problems.

  Timer 308 is started by the network when a RELEASE message is sent to the other end of the connection.

  If the RELEASE COMPLETE message is not received and the timer expires for the first time then the network restarts the timer and sends the RELEASE message again. In case the timer expires the second time, the call reference is released and the call state is set to NULL. Restart procedures for the the virtual channel are called.

  For strange reasons we were initially encountering core dump problems. The timer was being referenced after after its deletion. We tried to avoid this by not deleting the timer 308 but a new set of memory problems were encountered.

  We also tried to solve the problem by setting the expiry time to high values so that the timer does not expire and even if it expires the timer is restarted by setting it state to be Unexpired. This essentially means that we wait for the RELEASE COMPLETE message from the other end indefinitely. This scheme worked for some topologies and the we are still working to alleviate the problem completely by debugging and also running simulations in parallel.

  File References: q93b_timers.h, q93b_timers.cc, callrecTimer.h, callrecTimer.cc

- **Other Timers:** Apart from the timer 308, there were problems with timer Tguard which is a timer for the call reference values. This problem was removed by setting the expiry time for this timer to a high value. Most of the timer problems were encountered because of some inconsistencies in deleting timers. Some of them were deleted and some were not. We removed these inconsistencies and used an uniform policy with respect to all the timers.
• **PTSE Refresh Interval:** As per the PNNI specifications, when a significant change occurs, if the PTSE was last originated more than MinPTSEInterval time ago it may be re-originated again immediately. If the PTSE in question was originated less than MinPTSEInterval time ago, it must not be re-originated immediately. Because of the stale PTSE’s some of the calls were not setup and failed. We made modifications so that the PTSE’s were re-originated after a significant change and were conformant with the PNNI specifications.

File References: CACRoutingFSM.cc

• **Free Bandwidth:** Freeing the bandwidth is an essential function which is called as soon as call is completed. For a nrt-vbr calls the bandwidths were not freed and so the results we achieved were not as expected. We made modifications so that the simulator could process cbr and vbr calls as per the specifications.

File References: CACRoutingFSM.cc, port_info.cc

• **GCAC in the Fabric Module** The q-port’s implementation of the GCAC was found to be very preliminary without taking into account the types of the call. For example, in case of a vbr call the available link rate was checked if it could support the pcr or the call instead of checking for the a value between pcr and scr. Most of the calls failed because of this error. The GCAC of the q-port implementation was not used because the simulator performed the generic call control at a higher level.

File References: ParsedData.cc

• **Other Inconsistencies and Memory Leaks:** We used Insure++ software to detect memory leaks and other inconsistencies. This software is widely used in the industry to make the software error free and free of memory leaks. Many compile timer inconsistencies were removed but the software could not be used for runtime errors. We are trying to remove use Insure++ to detect runtime errors.

File References: Node.cc, HostInfo.cc, Callgen.cc
Chapter 5

Examples

This section lists various examples of the input scripts and the output generated by using these scripts.

5.1 Multiple Sources

5.1.1 First example for multiple sources

#The script consists of two classes of hosts which consist of two and three sources respectively.

parameter_block node spark {
    prop_constant = 25,
    default_flooding_period = 1800,
    default_flooding_factor = 2,
    flooding_threshold = 2,
    crankback_retries = 2,
    routing_policy = min_hop,
    reaggregation_timer = 100,
    numports = 20,
    process_time = 5.0,
    queue_size = 5000
};

#Host parameter blocks

parameter_block host voiceHost {
    calls = 30,
    sourcetype = multiple,
    numsources = 2,
    share1 = 20,
    share2 = 80,
    arrival_distribution = [exponential 10],
};

#First Source
    calltype1 = cbr,
duration_distribution1 = [exponential 100],
pcri = [uniform 80 100],

#Second Source
ctype2 = cbr,
duration_distribution2 = histogram,
histogram_dist2 duration {
    bins = 2,
    binwidth = 10,
    lowlimit = 10,
    shares = [ 50 50 ]
},
pcri2 = [uniform 30 50],

queue_size = 5000,
host_process_time = 3.0,
destinations = uniform_any

};

parameter_block host videoHost {
calls = 20,
stype = multiple,
nsource = 3,
che1 = 20,
che2 = 50,
che3 = 30,
arrival_distribution = [exponential 5],

#First Source
calltype1 = cbr,
duration_distribution1 = [exponential 50],
pcri1 = [uniform 60 80],

#Second Source
calltype2 = cbr,
duration_distribution2 = histogram,
histogram_dist2 hduration {
    bins = 4,
    binwidth = 10,
    lowlimit = 10,
    shares = [ 25 50 10 15 ]
},
pcri2 = [uniform 40 100],

#Third Source
calltype3 = vbr,
duration_distribution3 = [fixed 30],
pcri = histogram,
histogram_dist3 hpcr
{
  bins = 3,
  binwidth = 20,
  lowlimit = 0,
  shares = [ 50 35 15 ],
},
pcri2scr3 = [fixed 4.5],

queue_size = 5000,
host_process_time = 3.0,
destinations = uniform_any
};

# Peer group A.1
node A.1.1{
  parameter_block spark,
  leader = true,
  address = 0x4700000000000000a0101000000000000
};
	node A.1.2{
    parameter_block spark,
    address = 0x4700000000000000a0102000000000000
};
	node A.1.3{
    parameter_block spark,
    bordernode = true,
    aggr_token = 3,
    address = 0x4700000000000000a0103000000000000
};

# Peer group A.2
node A.2.1{
  parameter_block spark,
  leader = true,
  bordernode = true,
  aggr_token = 1,
  address = 0x4700000000000000a0201000000000000
};
	node A.2.2{
    parameter_block spark,
    address = 0x4700000000000000a0202000000000000

};

node A.2.3{
    parameter_block spark,
    bordernode = true,
    aggr_token = 3,
    address = 0x4700000000000000
};

# Peer group B.1
node B.1.1{
    parameter_block spark,
    leader = true,
    bordernode = true,
    aggr_token = 1,
    address = 0x4700000000000000
};

node B.1.2{
    parameter_block spark,
    address = 0x4700000000000000
};

node B.1.3{
    parameter_block spark,
    bordernode = true,
    aggr_token = 3,
    address = 0x4700000000000000
};

# Peer group B.2
node B.2.1{
    parameter_block spark,
    leader = true,
    bordernode = true,
    aggr_token = 1,
    address = 0x4700000000000000
};

node B.2.2{
    parameter_block spark,
    address = 0x4700000000000000
};

node B.2.3{
    parameter_block spark,
    address = 0x4700000000000000
}
host A.1.1{  
    parameter_block videoHost,  
    address = 0x470000000000000000a0101000000000100  
};

host A.2.3.1{
    parameter_block voiceHost,  
    address = 0x470000000000000000a0203000000000100
};

host B.1.3.1{
    parameter_block voiceHost,  
    address = 0x470000000000000000b010300000000000100
};

host B.2.3.1{
    parameter_block videoHost,  
    address = 0x470000000000000000b020300000000000100
};

host B.1.2.1{
    parameter_block videoHost,  
    address = 0x470000000000000000b010200000000000100
};

port genericport {bw=OC12, delay=10};

# connections within the peergroup A.1
connection A.1.1->A.1.2{bw=300, ad_weight = 10};
connection A.1.2->A.1.3{bw=300, ad_weight = 10};
connection A.1.3->A.1.1{bw=300, ad_weight = 10};

# connections within the peergroup A.2
connection A.2.1->A.2.2{bw=300, ad_weight = 20};
connection A.2.2->A.2.3{bw=300, ad_weight = 10};
connection A.2.3->A.2.1{bw=300, ad_weight = 10};

# connections within the peergroup B.1
connection B.1.1->B.1.2{bw=300, ad_weight = 10};
connection B.1.2->B.1.3{bw=300, ad_weight = 10};
connection B.1.3->B.1.1{bw=300, ad_weight = 10};

# connections within the peergroup B.2
connection B.2.1->B.2.2{bw=300, ad_weight = 20};
connection B.2.2->B.2.3{bw=300, ad_weight = 10};
connection B.2.3->B.2.1{bw=300, ad_weight = 10};

# physical connections across peer groups
connection A.1.3->A.2.1{bw=300, ad_weight = 30};
connection A.2.3->B.1.1{bw=300, ad_weight = 30};
connection B.1.3->B.2.1{bw=300, ad_weight = 30};

# host - node connections
connection A.1.1->A.1.1.1{bw=300, ad_weight = 60};
connection A.2.3->A.2.3.1{bw=300, ad_weight = 60};
connection B.1.3->B.1.3.1{bw=300, ad_weight = 60};
connection B.1.2->B.1.2.1{bw=300, ad_weight = 60};
connection B.2.3->B.2.3.1{bw=300, ad_weight = 60};

# logical nodes

logicalnode A.1{
    level = 88,
    child = A.1.1
};

logicalnode A.2{
    level = 88,
    child = A.2.1,
    aggr_token = 2
};

logicalnode B.1{
    level = 88,
    child = B.1.1,
    aggr_token = 1
};

logicalnode B.2{
    level = 88,
    child = B.2.1
};

logicalnode A{
    level = 80,
    child = A.1,
};

logicalnode B{
    level = 80,
child = B.1
};

# logical connections
logicalconnection A.1->A.2 { delay = 25 };
logicalconnection B.1->B.2 { delay = 25 };
logicalconnection A.2->B.1 { delay = 25 };
logicalconnection A->B { delay = 25 };

schedule{
  duration = 1000,
  mpg = true,
  nodal_represent = complex
};
5.1.1.1 Output

Output:

---- WELCOME TO KU PNNI SIMULATOR ----

Information and Telecommunication Technology Center (ITTC)
University of Kansas Center for Research, Inc.

For enquiries, please contact:
    KU    Dr. Douglas Niehaus    <niehaus@ittc.ku.edu>
    KU-PNNI Group     <pnni@ittc.ku.edu>
    SPRINT Sohel Khan   <sohel.khan@mail.sprint.com>
    Ph: 913 534 2914

To see the complete copyright (C) information please type
    kupnni -c

-----------------------------------------------
> Parsing scriptfile ... report1.script
> Random seed for the experiment is 195.045
> Presimulation processing ...
> Simulation Kernel instantiated ...
In SetupConvergenceControls()
Convergence Table
PeerGroup 88:4700000000000000000000000b000000 : 7
PeerGroup 88:4700000000000000000000000a000000 : 7
PeerGroup 80:4700000000000000000000000a000000 : 6
PeerGroup 96:4700000000000000000000000b020000 : 10
PeerGroup 96:4700000000000000000000000b010000 : 11
PeerGroup 96:4700000000000000000000000a020000 : 11
PeerGroup 96:4700000000000000000000000a010000 : 10
> Simulation started (virtual time) 0s 0ms
    ... Event Processing Loop starts ...
> Simulation stopped (virtual time) 1000s 0ms
    ... Event Processing Loop stops ...
> Printing simulation results ...

***** CALL SETUP LOGS START *****

-- A.1.1.1 host record begins ---------------------------
## A.1.1.1 host record ends

---

## A.2.3.1 host record begins

<table>
<thead>
<tr>
<th>No.</th>
<th>Destination calltype</th>
<th>bw(kbps)</th>
<th>arrival time</th>
<th>setuptime</th>
<th>result</th>
<th>duration/cause</th>
<th>pcr(cells/sec)</th>
<th>pcr2scr</th>
<th>mbs</th>
<th>ctd</th>
<th>cdv</th>
<th>clr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 B.1.1.1</td>
<td>cbr</td>
<td>83.952</td>
<td>00 m 23 s 000 ms 00 s 120.833 ms setup</td>
<td>00000099 s 000000 ms</td>
<td>198 N/A</td>
<td>0 0 0 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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**total cbr calls**: 30
**successful cbr calls**: 100%
**total cbr bw request**: 1.79734 Mbps
**cbr bw rejected**: 0 Mbps
**mean call setup time**: 00 s 140.442 ms

--- A.2.3.1 host record ends ------------------------------

--- B.1.2.1 host record begins ------------------------------
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<tr>
<td>17</td>
<td>B.1.2.1</td>
<td>cbr</td>
<td>46.64</td>
<td>02 m 56 s 478 ms 00 s 88.3870 ms setup</td>
<td>0000023 s 000000 ms</td>
<td>110 N/A 0 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>18</td>
<td>A.1.1.1</td>
<td>cbr</td>
<td>36.888</td>
<td>03 m 06 s 206 ms 00 s 213.228 ms setup</td>
<td>0000016 s 000000 ms</td>
<td>87 N/A 0 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>19</td>
<td>A.1.1.1</td>
<td>cbr</td>
<td>80.136</td>
<td>03 m 16 s 151 ms 00 s 218.220 ms setup</td>
<td>0000009 s 000000 ms</td>
<td>189 N/A 0 0 0 0</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>20</td>
<td>B.2.3.1</td>
<td>cbr</td>
<td>36.888</td>
<td>03 m 26 s 122 ms 00 s 130.930 ms setup</td>
<td>0000011 s 000000 ms</td>
<td>87 N/A 0 0 0 0</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>21</td>
<td>B.1.2.1</td>
<td>cbr</td>
<td>35.616</td>
<td>03 m 36 s 077 ms 00 s 98.3670 ms setup</td>
<td>0000015 s 000000 ms</td>
<td>84 N/A 0 0 0 0</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>A.1.1.1</td>
<td>cbr</td>
<td>45.368</td>
<td>03 m 46 s 096 ms 00 s 213.176 ms setup</td>
<td>0000013 s 000000 ms</td>
<td>107 N/A 0 0 0 0</td>
<td></td>
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</tr>
<tr>
<td>23</td>
<td>A.1.1.1</td>
<td>cbr</td>
<td>46.216</td>
<td>03 m 56 s 032 ms 00 s 273.960 ms setup</td>
<td>0000012 s 000000 ms</td>
<td>109 N/A 0 0 0 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>B.2.3.1</td>
<td>cbr</td>
<td>85.648</td>
<td>04 m 06 s 032 ms 00 s 125.703 ms setup</td>
<td>0000115 s 000000 ms</td>
<td>202 N/A 0 0 0 0</td>
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</tr>
<tr>
<td>25</td>
<td>B.1.2.1</td>
<td>cbr</td>
<td>43.672</td>
<td>04 m 16 s 211 ms 00 s 88.4140 ms setup</td>
<td>0000011 s 000000 ms</td>
<td>103 N/A 0 0 0 0</td>
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</tbody>
</table>
successfull nrtvbr calls : 100%
total nrtvbr bw request : 0.033072 Mbps
nrt vbr bw rejected : 0 Mbps
mean callsetup time : 00 s 228.764 ms

-- B.2.3.1 host record ends -----------------------------

AVG RESULTS OF ALL CALLS

total cbr calls : 107
successfull cbr calls : 100%
total cbr bw request : 6.52154 Mbps
cbr bw rejected : 0 Mbps
total nrtvbr calls : 13
successfull rtvbr calls : 100%
total nrtvbrbw request : 0.159424 Mbps
nrtvbr bw rejected : 0 Mbps
mean callsetup time : 00 s 182.404 ms

***** CALL SETUP LOGS END *********

##### NODE INSTRUMENTATION LOGS START #####

-- A.1.1 node record begins -----------------------------

convergence time for level 96 : 00 s 200 ms
convergence time for level 88 : 00 s 231.963 ms
convergence time for level 80 : 00 s 266.158 ms
avg hops : 2.75
calls routed successfully : 45
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
 crankback count : 0
 alternate routes succeeded : 0
avg routing time : 00 s 5.343 ms
avg aggregation time : 00 s 4.361 ms
total floods : 1353
total wasted floods : 320
pnni data sent : 178.236 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink

<table>
<thead>
<tr>
<th></th>
<th>96</th>
<th>88</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>2</td>
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<tr>
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<td>2</td>
<td>0</td>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

-- A.1.1 node record ends -----------------------------

-- A.1.2 node record begins -----------------------------

convergence time for level 96 : 00 s 195 ms
correction time for level 88 : 00 s 281.963 ms
correction time for level 80 : 00 s 341.158 ms
avg hops : 0
calls routed successfully : 0
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dblinfo failed calls : 0
lookup fail calls : 0
crankind count : 0
alternate routes succeeded : 0
avg routing time : 00 s 000 ms
avg aggregation time : 00 s 000 ms
total floods : 647
total wasted floods : 190
pmni data sent : 83.744 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink

<table>
<thead>
<tr>
<th></th>
<th>96</th>
<th>88</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>2</td>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

-- A.1.2 node record ends -----------------------------

-- A.1.3 node record begins -----------------------------

convergence time for level 96 : 00 s 185 ms
correction time for level 88 : 00 s 271.963 ms
correction time for level 80 : 00 s 341.158 ms
avg hops : 1
calls routed successfully : 45
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 5.387 ms
avg aggregation time : 00 s 000 ms
total floods : 649
total wasted floods : 154
pmni data sent : 87.188 kbps
Database size : 3.552 K8
No. of PTSEs : Level Nodal Complex HLink Uplink
              96   3   0   6   1
              88   2   2   2   1
              80   2   2   2   0

-- A.1.3 node record ends-----------------------------

-- A.2.1 node record begins-----------------------------

convergence time for level 96 : 00 s 200 ms
convergence time for level 88 : 00 s 227.449 ms
convergence time for level 80 : 00 s 321.183 ms
avg hops : 1.75
calls routed successfully : 45
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 5.931 ms
avg aggregation time : 00 s 2.04 ms
total floods : 909
total wasted floods : 293
pmni data sent : 122.424 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
                 96  3  0  6  2
                 88  2  2  2  1
                 80  2  2  2  0

-- A.2.1 node record ends  -----------------------------

-- A.2.2 node record begins  -----------------------------

convergence time for level 96 : 00 s 195 ms
convergence time for level 88 : 00 s 277.449 ms
convergence time for level 80 : 00 s 396.183 ms
avg hops : 0
calls routed successfully : 0
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dblinfo failed calls : 0
lookup fail calls : 0
crashback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 000 ms
avg aggregation time : 00 s 000 ms
total floods : 525
total wasted floods : 156
pmni data sent : 71.06 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
                 96  3  0  6  2
                 88  2  2  2  1
                 80  2  2  2  0

-- A.2.2 node record ends  -----------------------------

-- A.2.3 node record begins  -----------------------------

convergence time for level 96 : 00 s 185 ms
convergence time for level 88 : 00 s 267.449 ms
convergence time for level 80: 00 s 401.183 ms
avg hops: 1.45455
calls routed successfully: 75
calls confirmed from dest: 0
source failed calls: 0
source PeerGroup failed calls: 0
foreign PeerGroup failed calls: 0
dblinfo failed calls: 0
lookup fail calls: 0
crankback count: 0
alternate routes succeeded: 0
avg routing time: 00 s 4.883 ms
avg aggregation time: 00 s 000 ms
total floods: 549
total wasted floods: 130
pmni data sent: 79.656 kbps
Database size: 3.784 KB
No. of PTSEs: Level Nodal Complex HLink Uplink

96  3  0  6  2
88  2  2  2  1
80  2  2  2  0

-- A.2.3 node record ends -------------------------------------

-- B.1.1 node record begins ----------------------------------

convergence time for level 96: 00 s 200 ms
convergence time for level 88: 00 s 235.524 ms
convergence time for level 80: 00 s 268.05 ms
avg hops: 1.15556
calls routed successfully: 70
calls confirmed from dest: 0
source failed calls: 0
source PeerGroup failed calls: 0
foreign PeerGroup failed calls: 0
dblinfo failed calls: 0
lookup fail calls: 0
crankback count: 0
alternate routes succeeded: 0
avg routing time: 00 s 7.657 ms
avg aggregation time: 00 s 7.042 ms
total floods: 1349
total wasted floods : 270
pmni data sent : 183.36 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
96 3 0 6 2
88 2 2 2 1
80 2 2 2 0

-- B.1.1 node record ends ---------------------

-- B.1.2 node record begins ---------------------

convergence time for level 96 : 00 s 195 ms
convergence time for level 88 : 00 s 285.524 ms
convergence time for level 80 : 00 s 353.05 ms
avg hops : 1.75
calls routed successfully : 71
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 5.809 ms
avg aggregation time : 00 s 000 ms
total floods : 586
total wasted floods : 177
pmni data sent : 74.572 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
96 3 0 6 2
88 2 2 2 1
80 2 2 2 0

-- B.1.2 node record ends ---------------------

-- B.1.3 node record begins ---------------------

convergence time for level 96 : 00 s 185 ms
convergence time for level 88 : 00 s 275.524 ms
convergence time for level 80 : 00 s 353.05 ms
avg hops : 1.5
calls routed successfully : 82
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 5.698 ms
avg aggregation time : 00 s 000 ms
total floods : 586
total wasted floods : 145
pmni data sent : 80.304 kbps
Database size : 3.784 K8
No. of PTSEs : Level Nodal Complex HLink Uplink

<table>
<thead>
<tr>
<th></th>
<th>96</th>
<th>3</th>
<th>0</th>
<th>6</th>
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</tr>
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<tbody>
<tr>
<td>88</td>
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<td>2</td>
<td>2</td>
<td>1</td>
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</tr>
<tr>
<td>80</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
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</tr>
</tbody>
</table>

-- B.1.3 node record ends -------------------------------

-- B.2.1 node record begins -----------------------------

convergence time for level 96 : 00 s 215 ms
convergence time for level 88 : 00 s 240.753 ms
convergence time for level 80 : 00 s 333.075 ms
avg hops : 1
calls routed successfully : 49
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 5.762 ms
avg aggregation time : 00 s 1.956 ms
total floods : 972
total wasted floods : 263
pmni data sent : 136.528 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
96   3   0   6   1
88   2   2   2   1
80   2   2   2   0

-- B.2.1 node record ends -----------------------------------

-- B.2.2 node record begins -----------------------------------

convergence time for level 96 : 00 s 200 ms
convergence time for level 88 : 00 s 286.753 ms
convergence time for level 80 : 00 s 408.075 ms
avg hops : 0
calls routed successfully : 0
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 000 ms
avg aggregation time : 00 s 000 ms
total floods : 507
total wasted floods : 175
pmni data sent : 67.548 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
96   3   0   6   1
88   2   2   2   1
80   2   2   2   0

-- B.2.2 node record ends -----------------------------------

-- B.2.3 node record begins -----------------------------------
convergence time for level 96 : 00 s 190 ms
convergence time for level 88 : 00 s 286.753 ms
convergence time for level 80 : 00 s 413.075 ms
avg hops : 2.5
calls routed successfully : 49
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dbinfo failed calls : 0
lookup fail calls : 0
crakback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 9.745 ms
avg aggregation time : 00 s 000 ms
total floods : 552
total wasted floods : 134
pnni data sent : 80.052 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink

<table>
<thead>
<tr>
<th>Level</th>
<th>96</th>
<th>88</th>
<th>80</th>
</tr>
</thead>
<tbody>
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<tr>
<td>88</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>80</td>
<td>2</td>
<td>2</td>
<td>0</td>
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</tbody>
</table>

-- B.2.3 node record ends -----------------------------

AVG NODE RECORDS

convergence time low : 00 s 266.158 ms
convergence time high : 00 s 413.075 ms
avg hops : 1.65112
average database size : 3.668 KB
total floods : 9184
total wastedfloods : 2407
pnni bw low : 67.548
pnni bw high : 183.36
total pnni data : 1244.67 kbps

### NODE INSTRUMENTATION LOGS END ######

Note: Font size reduced to fit in a page
5.1.2 Example script showing how to override parameters:

This script consists of two classes of hosts which consist of two and three sources respectively. Some of the parameters declared in the parameter_block `voiceHost` will be overridden in the individual host blocks.

```cpp
parameter_block node spark {
    prop_constant = 25,
    default_flooding_period = 1800,
    default_flooding_factor = 2,
    flooding_threshold = 2,
    crankback_retries = 2,
    routing_policy = min_hop,
    reaggregation_timer = 100,
    numports = 20,
    process_time = 5.0,
    queuesize = 5000
};

#Host parameter blocks

parameter_block host voiceHost {
    calls = 30,
    sourcetype = multiple,
    numsources = 2,
    share1 = 20,
    share2 = 80,
    arrival_distribution = [exponential 10],
}

#First Source
    calltype1 = cbr,
    duration_distribution1 = [exponential 5],
    pcrl = [uniform 10 20],

#Second Source
    calltype2 = cbr,
    duration_distribution2 = histogram,
    histogram_dist2 hduration {
        bins = 2,
        binwidth = 10,
        lowlimit = 10,
        shares = [ 50 50]
    },
    pcrl2 = [uniform 30 50],

    queuesize = 5000,
    host_process_time = 3.0,
```
destinations = uniform_any

parameter_block host videoHost {
calls = 200,
sourcetype = multiple,
umsources = 3,
share1 = 20,
share2 = 50,
share3 = 30,
arrival_distribution = [exponential 20],

#First Source
calltype1 = cbr,
duration_distribution1 = [exponential 5],
prc1 = [uniform 60 80],

#Second Source
calltype2 = cbr,
duration_distribution2 = histogram,

histogram_dist2 hduration {
bins = 4,
binwidth = 10,
lowlimit = 10,
shares = [ 25 50 10 15]
},
prc2 = [uniform 20 30],

#Third Source
calltype3 = vbr,
duration_distribution3 = [fixed 10],
prc3 = histogram,

histogram_dist3 hprc {
bins = 3,
binwidth = 20,
lowlimit = 0,
shares = [ 50 35 15]
},
prc2scr3 = [fixed 5.5],

queuesize = 5000,
host_process_time = 3.0,

destinations = uniform_any

}
# Peer group A.1
node A.1.1{
    parameter_block spark,
    leader = true,
    address = 0x4700000000000000000000000000000
};

node A.1.2{
    parameter_block spark,
    address = 0x4700000000000000000000000000000
};

node A.1.3{
    parameter_block spark,
    bordernode = true,
    aggr_token = 3,
    address = 0x4700000000000000000000000000000
};

# Peer group A.2
node A.2.1{
    parameter_block spark,
    leader = true,
    bordernode = true,
    aggr_token = 1,
    address = 0x4700000000000000000000000000000
};

node A.2.2{
    parameter_block spark,
    address = 0x4700000000000000000000000000000
};

node A.2.3{
    parameter_block spark,
    bordernode = true,
    aggr_token = 3,
    address = 0x4700000000000000000000000000000
};

# Peer group B.1
node B.1.1{
    parameter_block spark,
    leader = true,
    bordernode = true,
    aggr_token = 1,
    address = 0x4700000000000000000000000000000
}
node B.1.2{
    parameter_block spark,
    address = 0x470000000000000000000000
};

node B.1.3{
    parameter_block spark,
    bordernode = true,
    aggr_token = 3,
    address = 0x470000000000000000000000
};

# Peer group B.2
node B.2.1{
    parameter_block spark,
    leader = true,
    bordernode = true,
    aggr_token = 1,
    address = 0x470000000000000000000000
};

node B.2.2{
    parameter_block spark,
    address = 0x470000000000000000000000
};

node B.2.3{
    parameter_block spark,
    address = 0x470000000000000000000000
};

host A.1.1.1{
    parameter_block videoHost,
    address = 0x470000000000000000000000a101000000000100
};

host A.2.3.1{
    parameter_block voiceHost,
    address = 0x470000000000000000000000a02030000000000100
}

#Overiding the parameters of generic block
calltype1 = vbr,
pol2scr1 = [fixed 2]
};

host B.1.3.1{
parameter_block voiceHost,
    address = 0x47000000000000000000000b01030000000000100
};

host B.2.3.1{
    parameter_block videoHost,
    address = 0x47000000000000000000000b02030000000000100

    # Overriding the parameters of generic block videoHost
    # and creating four sources for this host only.
    # Note that we need to sepcify the parameters of all
    # the fours sources again.

    numsources = 4,

    # Source 1
    calltype1 = cbr,
    share1 = 20,
    pcr1 = histogram,
    histogram_dist1 hpcr
        {
            bins = 2,
            binwidth = 5,
            lowlimit = 5,
            shares = [ 50 50 ]
        },
    pcr2scr1 = [uniform 2 6],
    duration_distribution1 = [uniform 15 23],
    mbs1 = [uniform 4 8],
    ctd1 = [uniform 5 10],
    cdv1 = [fixed 2],
    clr1 = [uniform 1 4],

    # Source 2
    calltype2 = vbr,
    share2 = 30,
    pcr2 = [fixed 100],
    pcr2scr2 = [fixed 1.5],
    duration_distribution2 = [uniform 24 36 ],

    # Source 3
    calltype3 = vbr,
    share3 = 10,
    pcr2 = [fixed 30],
    pcr2scr2 = [fixed 2.5],
    duration_distribution2 = [uniform 54 68 ],

    # Source 4
    calltype4 = cbr,
share2 = 40,
rc2 = [exponential 50],
duration_distribution2 = [fixed 40 ]
);

host B.1.2.1{
  parameter_block videoHost,
  address = 0x470000000000000000000000b010200000000000100
};

port genericport {bw=OC12, delay=10};

# connections within the peer group A.1
connection A.1.1->A.1.2{bw=300, ad_weight = 10};
connection A.1.2->A.1.3{bw=300, ad_weight = 10};
connection A.1.3->A.1.1{bw=300, ad_weight = 10};

# connections within the peer group A.2
connection A.2.1->A.2.2{bw=300, ad_weight = 20};
connection A.2.2->A.2.3{bw=300, ad_weight = 10};
connection A.2.3->A.2.1{bw=300, ad_weight = 10};

# connections within the peer group B.1
connection B.1.1->B.1.2{bw=300, ad_weight = 10};
connection B.1.2->B.1.3{bw=300, ad_weight = 10};
connection B.1.3->B.1.1{bw=300, ad_weight = 10};

# connections within the peer group B.2
connection B.2.1->B.2.2{bw=300, ad_weight = 20};
connection B.2.2->B.2.3{bw=300, ad_weight = 10};
connection B.2.3->B.2.1{bw=300, ad_weight = 10};

# physical connections across peer groups
connection A.1.3->A.2.1{bw=300, ad_weight = 30};
connection A.2.3->B.1.1{bw=300, ad_weight = 30};
connection B.1.3->B.2.1{bw=300, ad_weight = 30};

# host - node connections
connection A.1.1->A.1.1.1{bw=300, ad_weight = 60};
connection A.2.3->A.2.3.1{bw=300, ad_weight = 60};
connection B.1.3->B.1.3.1{bw=300, ad_weight = 60};
connection B.1.2->B.1.2.1{bw=300, ad_weight = 60};
connection B.2.3->B.2.3.1{bw=300, ad_weight = 60};

# logical nodes
logicalnode A.1{
    level = 88,
    child = A.1.1
};

logicalnode A.2{
    level = 88,
    child = A.2.1,
    aggr_token = 2
};

logicalnode B.1{
    level = 88,
    child = B.1.1,
    aggr_token = 1
};

logicalnode B.2{
    level = 88,
    child = B.2.1
};

logicalnode A{
    level = 80,
    child = A.1,
};

logicalnode B{
    level = 80,
    child = B.1
};

# logical connections
logicalconnection A.1->A.2{ delay = 25 }
logicalconnection B.1->B.2{ delay = 25 }
logicalconnection A.2->B.1{ delay = 25 }
logicalconnection A->B{ delay = 25 }

schedule{
    duration = 1000,
    mpg = true,
    nodal_represent = complex
};
5.1.2.1 Output

Output:

---- WELCOME TO KU PN NI SIMULATOR ----

Information and Telecommunication Technology Center (ITTC)
University of Kansas Center for Research, Inc.

For enquiries, please contact:
   KU     Dr. Douglas Niehaus     <niehaus@ittc.ku.edu>
   KU-PN NI Group       <pnni@ittc.ku.edu>
   SPRINT   Sohel Khan        <sohel.khan@mail.sprint.com>
   Ph: 913 534 2914

To see the complete copyright (C) information please type
   kupnni -c

-----------------------------------------------

> Parsing scriptfile ... report2.script
> Random seed for the experiment is 195.045
> Presimulation processing ...
> Simulation Kernel instantiated ...
In SetupConvergenceControls() 
Convergence Table
   PeerGroup 88:4700000000000000000000000000000000 : 7
   PeerGroup 88:4700000000000000000000000000000000 : 7
   PeerGroup 80:4700000000000000000000000000000000 : 6
   PeerGroup 96:4700000000000000000000000000000000 : 10
   PeerGroup 96:4700000000000000000000000000000000 : 11
   PeerGroup 96:4700000000000000000000000000000000 : 11
   PeerGroup 96:4700000000000000000000000000000000 : 10
   PeerGroup 96:4700000000000000000000000000000000 : 10
> Simulation started (virtual time) 0s 0ms
   ... Event Processing Loop starts ...
> Simulation stopped (virtual time) 1000s 0ms
   ... Event Processing Loop stops ...
> Printing simulation results ...

***** CALL SETUP LOGS START *****

-- A.1.1.1 host record begins ------------------------

No. Destination calltype bw(kbps) arrival time setup time result duration/cause pcr(cells/sec) pcr2scr mbs ctd cdv clr
total nrtvbr calls : 12
successfull nrtvbr calls : 100%
total nrtvbr bw request : 0.166208 Mbps
nrt vbr bw rejected : 0 Mbps
mean callsetup time : 00 s 208.127 ms

-- A.1.1.1 host record ends --------------------------

-- A.2.3.1 host record begins -------------------------

<table>
<thead>
<tr>
<th>No.</th>
<th>Destination</th>
<th>calltype</th>
<th>bw(kbps)</th>
<th>arrival time</th>
<th>setuptime</th>
<th>result</th>
<th>duration/cause</th>
<th>pcr(cells/sec)</th>
<th>pcr2scr</th>
<th>mbs</th>
<th>ctd</th>
<th>cdv</th>
<th>clr</th>
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<td>00000012 s 000000 ms</td>
<td>100 N/A 0 0 0 0 0</td>
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</table>

total cbr calls : 25
successfull cbr calls : 100%
total cbr bw request : 1.0371 Mbps
cbr bw rejected : 0 Mbps
total nrtvbr calls : 5
successfull nrtvbr calls : 100%
total nrtvbr bw request : 0.05088 Mbps
nrt vbr bw rejected : 0 Mbps
mean call setup time : 00 s 155.085 ms

-- A.2.3.1 host record ends -----------------------------

-- B.1.2.1 host record begins -----------------------------

<table>
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<th>setup time</th>
<th>result</th>
<th>duration/cause</th>
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<th>pcr2scr</th>
<th>mbs</th>
<th>ctd</th>
<th>cdv</th>
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<td>150.767 ms setup</td>
<td>00000010 s 000000 ms</td>
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<td>151.428 ms setup</td>
<td>00000017 s 000000 ms</td>
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<td>00000029 s 000000 ms</td>
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<td>B.2.3.1 cbr</td>
<td>60.632</td>
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<td>150.829 ms setup</td>
<td>00000003 s 000000 ms</td>
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30 B.2.3.1 cbr 25.016 10 m 07 s 828 ms 00 s 161.769 ms setup 0000034 s 00000 ms 59 N/A 0 0 0 0
31 B.2.3.1 cbr 22.048 10 m 27 s 957 ms 00 s 150.777 ms setup 0000010 s 000000 ms 52 N/A 0 0 0 0
32 B.1.3.1 nrtvbr 11.448 10 m 47 s 836 ms 00 s 99.180 ms setup 0000010 s 000000 ms 58 5.5 0 0 0
33 B.2.3.1 cbr 27.56 11 m 07 s 813 ms 00 s 150.713 ms setup 0000040 s 000000 ms 65 N/A 0 0 0 0
34 B.2.3.1 cbr 64.872 11 m 27 s 750 ms 00 s 150.775 ms setup 0000005 s 000000 ms 153 N/A 0 0 0 0
35 B.2.3.1 cbr 24.168 11 m 47 s 739 ms 00 s 150.989 ms setup 0000022 s 000000 ms 57 N/A 0 0 0 0
36 B.1.3.1 cbr 62.328 12 m 07 s 874 ms 00 s 88.4110 ms setup 0000004 s 000000 ms 147 N/A 0 0 0 0
37 B.2.3.1 cbr 29.256 12 m 27 s 803 ms 00 s 150.810 ms setup 0000025 s 000000 ms 69 N/A 0 0 0 0
38 B.2.3.1 nrtvbr 4.664 12 m 47 s 769 ms 00 s 150.781 ms setup 0000010 s 000000 ms 26 5.5 0 0 0
39 B.2.3.1 cbr 70.808 13 m 07 s 889 ms 00 s 151.243 ms setup 0000003 s 000000 ms 167 N/A 0 0 0 0
40 B.1.3.1 cbr 70.808 13 m 27 s 841 ms 00 s 88.4310 ms setup 0000007 s 000000 ms 167 N/A 0 0 0 0
41 B.2.3.1 nrtvbr 0 13 m 48 s 072 ms 00 s 150.953 ms setup 0000010 s 000000 ms 3 5.5 0 0 0
42 B.2.3.1 nrtvbr 10.176 14 m 07 s 828 ms 00 s 160.770 ms setup 0000010 s 000000 ms 52 5.5 0 0 0
43 B.2.3.1 cbr 25.016 14 m 27 s 651 ms 00 s 150.758 ms setup 0000029 s 000000 ms 59 N/A 0 0 0
44 B.1.3.1 cbr 23.32 14 m 47 s 544 ms 00 s 88.4020 ms setup 0000015 s 000000 ms 55 N/A 0 0 0
45 B.2.3.1 cbr 67.84 15 m 07 s 554 ms 00 s 155.929 ms setup 0000007 s 000000 ms 160 N/A 0 0 0
46 B.2.3.1 nrtvbr 6.784 15 m 27 s 544 ms 00 s 150.814 ms setup 0000010 s 000000 ms 37 5.5 0 0 0
47 B.2.3.1 cbr 26.288 15 m 47 s 355 ms 00 s 150.773 ms setup 0000027 s 000000 ms 62 N/A 0 0 0
48 B.1.3.1 nrtvbr 10.176 16 m 07 s 440 ms 00 s 88.3660 ms setup 0000010 s 000000 ms 52 5.5 0 0 0
49 B.2.3.1 cbr 27.984 16 m 27 s 603 ms 00 s 150.753 ms setup 0000024 s 000000 ms 66 N/A 0 0 0

total cbr calls : 32
successfull cbr calls : 100%
total cbr bw request : 1.04474 Mbps
cbr bw rejected : 0 Mbps
total nrtvbr calls : 17
successfull nrtvbr calls : 100%
total nrtvbr bw request : 0.179352 Mbps
nrt vbr bw rejected : 0 Mbps
mean callsetup time : 00 s 139.224 ms

-- B.1.2.1 host record ends -----------------------------

-- B.1.3.1 host record begins -----------------------------

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<th>arrival time</th>
<th>setuptime</th>
<th>result</th>
<th>duration/cause</th>
<th>pcr(cells/sec)</th>
<th>pcr2scr</th>
<th>mbs</th>
<th>ctd</th>
<th>cdv</th>
<th>clr</th>
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<td>00000014 s 000000 ms</td>
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<td>7</td>
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<td>76</td>
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total cbr calls : 30
successful cbr calls : 100%
total cbr bw request : 1.11809 Mbps
cbr bw rejected : 0 Mbps
mean call setup time : 0 s 175.9 ms

-- B.1.2.1 host record ends ------------------------------

-- B.2.3.1 host record begins -----------------------------

<table>
<thead>
<tr>
<th>No.</th>
<th>Destination</th>
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<th>setuptime</th>
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<th>pcrcr</th>
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<th>clr</th>
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<td>cbr</td>
<td>12,72</td>
<td>01 m 08 s 724 ms 00 s 150.736 ms setup</td>
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<td>01 m 28 s 835 ms 00 s 316.802 ms setup</td>
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<td>150</td>
<td>N/A</td>
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<td>000000001 s 000000 ms</td>
<td>150</td>
<td>N/A</td>
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</table>
successfull cbr calls : 100%
total cbr bw request : 1.24826 Mbps
cbr bw rejected : 0 Mbps
total nrtvbr calls : 21
successfull nrtvbr calls : 100%
total nrtvbr bw request : 0.901 Mbps
nrtvbr bw rejected : 0 Mbps
mean callsetup time : 00 s 231.01 ms

-- B.2.3.1 host record ends --------------------------

AVG RESULTS OF ALL CALLS

total cbr calls : 152
successfull cbr calls : 100%
total cbr bw request : 5.9237 Mbps
cbr bw rejected : 0 Mbps
total nrtvbr calls : 55
successfull nrtvbr calls : 100%
total nrtvbr bw request : 1.29744 Mbps
nrtvbr bw rejected : 0 Mbps
mean callsetup time : 00 s 184.875 ms

***** CALL SETUP LOGS END *********

####### NODE INSTRUMENTATION LOGS START #######

-- A.1.1 node record begins --------------------------

correction time for level 96 : 00 s 200 ms
correction time for level 88 : 00 s 232.481 ms
correction time for level 80 : 00 s 266.168 ms
avg hops : 2.7551
calls routed successfully : 89
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 4.148 ms
avg aggregation time : 00 s 6.223 ms
total floods : 1272
total wasted floods : 285
pmni data sent : 174.048 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
   96 3 0 6 1
   88 2 2 2 1
   80 2 2 2 0

-- A.1.1 node record ends -----------------------------

-- A.1.2 node record begins -----------------------------

convergence time for level 96 : 00 s 195 ms
convergence time for level 88 : 00 s 282.481 ms
convergence time for level 80 : 00 s 346.168 ms
avg hops : 0
calls routed successfully : 0
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dbinfo failed calls : 0
lookup fail calls : 0
crakback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 000 ms
avg aggregation time : 00 s 000 ms
total floods : 573
total wasted floods : 162
pmni data sent : 75.944 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
   96 3 0 6 1
   88 2 2 2 1
   80 2 2 2 0

-- A.1.2 node record ends -----------------------------

-- A.1.3 node record begins -----------------------------
convergence time for level 96 : 00 s 185 ms
convergence time for level 88 : 00 s 272.481 ms
convergence time for level 80 : 00 s 346.168 ms
avg hops : 1
calls routed successfully : 89
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
 crankback count : 0
 alternate routes succeeded : 0
avg routing time : 00 s 3.087 ms
avg aggregation time : 00 s 000 ms
total floods : 538
total wasted floods : 172
pmni data sent : 74.216 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
             96 3  0  6  1
             88 2  2  2  1
             80 2  2  2  0

-- A.1.3 node record ends -----------------------------

-- A.2.1 node record begins -----------------------------

convergence time for level 96 : 00 s 200 ms
convergence time for level 88 : 00 s 227.452 ms
convergence time for level 80 : 00 s 326.193 ms
avg hops : 1.7551
calls routed successfully : 89
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
 crankback count : 0
 alternate routes succeeded : 0
avg routing time : 00 s 6.533 ms
avg aggregation time : 00 s 8.189 ms
total floods : 910
total wasted floods : 245
pmni data sent : 130.548 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLInk Uplink

96 3 0 6 2
88 2 2 2 1
80 2 2 2 0

-- A.2.1 node record ends -------------------------------

-- A.2.2 node record begins -------------------------------

corvergence time for level 96 : 00 s 195 ms
corvergence time for level 88 : 00 s 277.452 ms
corvergence time for level 80 : 00 s 406.193 ms
avg hops : 0
calls routed successfully : 0
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls : 0
lookup fail calls : 0
 crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 000 ms
avg aggregation time : 00 s 000 ms
total floods : 489
total wasted floods : 167
pmni data sent : 68.172 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLInk Uplink

96 3 0 6 2
88 2 2 2 1
80 2 2 2 0

-- A.2.2 node record ends -------------------------------
-- A.2.3 node record begins ---------------------------------------

convergence time for level 96 : 00 s 185 ms
convergence time for level 88 : 00 s 267.452 ms
convergence time for level 80 : 00 s 396.193 ms
avg hops 
  : 1.57143
calls routed successfully 
  : 119
calls confirmed from dest 
  : 0
source failed calls 
  : 0
source PeerGroup failed calls 
  : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls 
  : 0
lookup fail calls 
  : 0
crankback count 
  : 0
alternate routes succeeded 
  : 0
avg routing time 
  : 00 s 6.67 ms
avg aggregation time 
  : 00 s 000 ms
total floods 
  : 505
total wasted floods 
  : 170
pmni data sent 
  : 71.396 kbps
Database size 
  : 3.784 KB
No. of PTSEs 
  : Level Nodal Complex HLink Uplink
                        96   3   0   6   2
                        88   2   2   2   1
                        80   2   2   2   0

-- A.2.3 node record ends ----------------------------------------

-- B.1.1 node record begins ------------------------------------

convergence time for level 96 : 00 s 200 ms
convergence time for level 88 : 00 s 235.525 ms
convergence time for level 80 : 00 s 268.532 ms
avg hops 
  : 1.10448
calls routed successfully 
  : 107
calls confirmed from dest 
  : 0
source failed calls 
  : 0
source PeerGroup failed calls 
  : 0
foreign PeerGroup failed calls: 0
dblinfo failed calls 
  : 0
lookup fail calls 
  : 0
crankback count 
  : 0
alternate routes succeeded : 0
avg routing time : 00 s 3.986 ms
avg aggregation time : 00 s 5.632 ms
total floods : 1476
total wasted floods : 303
pmni data sent : 204.204 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
                96  3  0  6  2
                88  2  2  2  1
                80  2  2  2  0

-- B.1.1 node record ends ----------------------------

-- B.1.2 node record begins ----------------------------

correction time for level 96 : 00 s 195 ms
correction time for level 88 : 00 s 285.525 ms
correction time for level 80 : 00 s 353.532 ms
avg hops : 1.7551
calls routed successfully : 129
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dbinfo failed calls : 0
lookup fail calls : 0
 crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 2.725 ms
avg aggregation time : 00 s 000 ms
total floods : 683
total wasted floods : 212
pmni data sent : 89.56 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
                96  3  0  6  2
                88  2  2  2  1
                80  2  2  2  0

-- B.1.2 node record ends ----------------------------
-- B.1.3 node record begins ------------------------

convergence time for level 96 : 00 s 185 ms
corvergence time for level 88 : 00 s 275.525 ms
corvergence time for level 80 : 00 s 353.532 ms
avg hops : 1.50633
calls routed successfully : 147
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dbinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 7.166 ms
avg aggregation time : 00 s 000 ms
total floods : 666
total wasted floods : 167
pmni data sent : 94.04 kbps
Database size : 3.784 KB
No. of PTSEs : Level Nodal Complex HLink Uplink
  96 3 0 6 2
  88 2 2 2 1
  80 2 2 2 0

-- B.1.3 node record ends ------------------------

-- B.2.1 node record begins ------------------------

convergence time for level 96 : 00 s 215 ms
corvergence time for level 88 : 00 s 246.485 ms
corvergence time for level 80 : 00 s 333.557 ms
avg hops : 1
calls routed successfully : 100
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls: 0
dbinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 3.643 ms
avg aggregation time : 00 s 1.823 ms
total floods : 949
total wasted floods : 301
pmni data sent : 129.152 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink

96 3 0 6 1
88 2 2 2 1
80 2 2 2 0

-- B.2.1 node record ends -----------------------------

-- B.2.2 node record begins -----------------------------

convergence time for level 96 : 00 s 200 ms
convergence time for level 88 : 00 s 291.485 ms
convergence time for level 80 : 00 s 423.557 ms
avg hops : 0
calls routed successfully : 0
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 000 ms
avg aggregation time : 00 s 000 ms
total floods : 554
total wasted floods : 143
pmni data sent : 77.496 kbps
Database size : 3.552 KB
No. of PTSEs : Level Nodal Complex HLink Uplink

96 3 0 6 1
88 2 2 2 1
80 2 2 2 0
-- B.2.2 node record ends -----------------------------

-- B.2.3 node record begins -----------------------------

convergence time for level 96 : 00 s 190 ms
convergence time for level 88 : 00 s 291.485 ms
convergence time for level 80 : 00 s 408.557 ms
avg hops : 2.5102
calls routed successfully : 100
calls confirmed from dest : 0
source failed calls : 0
source PeerGroup failed calls : 0
foreign PeerGroup failed calls : 0
dblinfo failed calls : 0
lookup fail calls : 0
crankback count : 0
alternate routes succeeded : 0
avg routing time : 00 s 5.342 ms
avg aggregation time : 00 s 000 ms
total floods : 509
total wasted floods : 141
pmni data sent : 73.38 kbps
Database size : 3.552 K8
No. of PTSEs : Level Nodal Complex HLink Uplink

<table>
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<td>2</td>
<td>2</td>
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<tr>
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<td>80</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
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</tbody>
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-- B.2.3 node record ends -----------------------------

AVG NODE RECORDS

convergence time low : 00 s 266.168 ms
convergence time high : 00 s 423.557 ms
avg hops : 1.66197
average database size : 3.668 K8
total floods : 9124
total wastedfloods : 2468
pmni bw low : 68.172
pmni bw high : 204.204
total pmni data : 1262.16 kbps