



Importing Traffic and Growth Rates

This chapter describes how to import traffic and traffic growth rates into a plan file. It also describes how demand grouping traffic can be used in forecasting, as well as *representative* plan files, which combine traffic from multiple files.

Traffic and Growth Rate Imports

You can import information in plan files:

- Traffic for existing interfaces, nodes, LSPs, ports, demands, and flows.
- New demands and flows with traffic.
- Growth rates for interfaces and demands. You have the option to import growth rates per interface, per demand, or per tag.

You can import traffic from one plan file into another. You can also import traffic from other data sources using files containing tab-delimited traffic tables.

Import Rules

WAE Design applies the following rules when importing traffic and growth. See [Table 4-1](#) for a list of required tables, depending on what you are importing.

- Regardless of the object you are importing and regardless of whether importing traffic or growth, a traffic table must exist either within a plan file or within tab-delimited tables. When you import the traffic, the traffic tables are imported directly into the plan file.
- The interfaces, nodes, LSPs, and ports being imported must exist in the plan file into which you are importing traffic. For example, if importing interfaces, the Interfaces (<Interfaces>) table must exist and each interface identified in the traffic table must exist within the Interfaces table. If an object is in the traffic table, but is not in the plan file into which you are importing the traffic, the object is ignored.

The same is true for demands and flows if they are not new. If they are new and do not yet exist in the plan file, you must create an object table (Demands or Flows table) for them in addition to creating their traffic table.

- Interface and demand growth rates imported using tags require an additional import growth table. This table is not directly imported into the plan, but rather is applied to the GrowthPercent column in the traffic table. The growth percent is then applied to all the interfaces or demands that have a tag corresponding to the Tag column in the import growth table.

Table 4-1 Required Tables for Importing Traffic and Growth Rates

If Importing...	Use These Tables...	See...
Interface traffic	<InterfaceTraffic>	Table 4-2
Growth rates per interface	<InterfaceTraffic>	Table 4-2
Growth rates per interface tag	<InterfaceTraffic> and <InterfacesGrowth>	Table 4-2 and Table 4-8
Node traffic	<NodeTraffic>	Table 4-3
LSP traffic	<LSPTraffic>	Table 4-4
Ports traffic	<PortTraffic>	Table 4-5
Demand traffic for existing demands	<DemandTraffic>	Table 4-6
Demand traffic for new demands	<DemandTraffic> and <Demands>	Table 4-6
Growth rates per demand	<DemandTraffic>	Table 4-6
Growth rates per demand tag	<DemandTraffic> and <DemandsGrowth>	Table 4-6 and Table 4-8
Flow traffic for existing flows	<FlowTraffic>	Table 4-7
Flow traffic for new flows	<FlowTraffic> and <Flows>	Table 4-7

Traffic Tables

To import traffic, you must have a viable traffic table for each type of traffic you are importing ([Table 4-1](#)). Possible sources for these tables are:

- An existing plan file.
- A .txt file containing the traffic table, which might be manually created or derived from other sources.

Each traffic table must be tab-delimited and contain required “key” columns (see [Table 4-2](#) through [Table 4-7](#)). You can modify the tables using Excel or a text editor.

Table 4-2 <InterfaceTraffic> Table

Column	Description
Node	You must either specify both the name of the source node (Node) and the interface name (Interface), or you must specify the IP address (IPAddress). The interface must exist in the <Interfaces> table using either the same node and interface combination or using the same IP address.
Interface	
IPAddress	
Queue	Use if you are importing traffic into a specific interface queue. If it does not exist, the interface queue will be created. If omitted, traffic is imported as undifferentiated.
TrafficLevel	Use if you are importing traffic into a specific travel level. If it does not exist, the traffic level will be created. If omitted, traffic is imported to the Default traffic level.
TraffMeas	Enter the amount of traffic (in Mbps) that you are importing. Required if importing traffic.
GrowthPercent	Enter the percentage by which you are growing the traffic. Required if importing growth rates.

Table 4-3 **<NodeTraffic> Table**

Column	Description
Node	You must either specify the node name (Node) or the IP address (IPAddress). The node must exist in the <Nodes> table using either the same node name or IP address.
IP Address	
Queue	Use if you are importing traffic into a specific interface queue. If it does not exist, the interface queue will be created. If omitted, traffic is imported as undifferentiated.
TrafficLevel	Use if you are importing traffic into a specific travel level. If it does not exist, the traffic level will be created. If omitted, traffic is imported to the Default traffic level.
SrcTraffMeas	Amount of in Mbps that is leaving the node.
DestTraffMeas	Amount of traffic in Mbps that is destined for the node.

Table 4-4 **<LSPTraffic> Table**

Column	Description
Name	You must either specify both the LSP name (Name) and source node name (Source), or you must specify the IP address (SourceIP). The LSP must exist in the <LSPs> table using either the same LSP name and source node name combination or using the same IP address for the source node.
Source	
SourceIP	
Queue	Use if you are importing traffic into a specific interface queue. If it does not exist, the interface queue will be created. If omitted, traffic is imported as undifferentiated.
TrafficLevel	Use if you are importing traffic into a specific travel level. If it does not exist, the traffic level will be created. If omitted, traffic is imported to the Default traffic level.
TraffMeas	Enter the amount of traffic (in Mbps) that you are importing. Required if importing traffic.

Table 4-5 **<PortTraffic> Table**

Column	Description
Node	Name of the node containing the port. Must reside in the <Nodes> table.
Port	Port name. Must reside in the <Ports> table with the same node that is identified in the Node column.
Queue	Use if you are importing traffic into a specific interface queue. If it does not exist, the interface queue will be created. If omitted, traffic is imported as undifferentiated.
TrafficLevel	Use if you are importing traffic into a specific travel level. If it does not exist, the traffic level will be created. If omitted, traffic is imported to the Default traffic level.
TraffMeas	Enter the amount of traffic (in Mbps) that you are importing. Required if importing traffic.

Table 4-6 Required Columns for <Demands> and <DemandTraffic> Tables

Table	Column	Description
<Demands> and <DemandTraffic>	Name	Demand name. If not specified, the default is empty.
	Source	Name of the source node. Must exist in the <Nodes> table.
	Destination	Name of the destination node. Must exist in the <Nodes> table.
	ServiceClass	Use if you are importing traffic into a specific service class. If it does not exist, the service class will be created. If omitted, traffic is imported to the Default service class.
<DemandTraffic>	TrafficLevel	Use if you are importing traffic into a specific travel level. If it does not exist, the traffic level will be created. If omitted, traffic is imported to the Default traffic level.
	Traffic	Enter the amount of traffic (in Mbps) that you are importing. Required if importing traffic.
	GrowthPercent	Enter the percentage by which you are growing the demand traffic. Required if importing growth rates.

Table 4-7 Required Columns for <Flows> and <FlowTraffic> Tables

Table	Column	Description
<Flows> and <FlowTraffic>	FlowID	Demand name. If not specified, the default is empty.
<FlowTraffic>	TrafficLevel	Use if you are importing traffic into a specific travel level. If it does not exist, the traffic level will be created. If omitted, traffic is imported to the Default traffic level.
	Queue	Use if you are importing traffic into a specific interface queue. If it does not exist, the interface queue will be created. If omitted, traffic is imported as undifferentiated.
	TrafficMeas	Enter the amount of traffic (in Mbps) that you are importing.

Growth Tables

Using a growth table, you can apply growth rates to only tagged interfaces or tagged demands. The parameters identified in a growth table are applied to an associated traffic table, but are not directly imported as a table into a plan file.

There are two growth tables: <InterfacesGrowth> and <DemandsGrowth>. Each of these have only two columns.

Table 4-8 Columns in <InterfacesGrowth> and <DemandsGrowth> Tables

Column	Description
GrowthPercent	The growth rate for the undifferentiated service class in one time period. This GrowthPercent overwrites the GrowthPercent column in the <InterfaceTraffic> or <DemandTraffic> table, depending on what you are importing.
Tag	A tag value for the growth rate, which associates it with interfaces or demands that have the same tag value. Therefore, a Tag column with this tag value must exist in the <Interfaces> or <Demands> table, depending on what you are importing.

This is an efficient means of simultaneously applying growth rates to numerous interfaces or demands at one time. For example, if you have a 1,000 demands that used two tags, you could create a <DemandsGrowth> table with only two rows (one for each tag) versus creating a <DemandTraffic> table with 1,000 entries (one per demand).

Import Traffic and Growth Rates

To Import...	Use...	Table Prerequisites
Traffic into interfaces, nodes, ports, demands, or flows	File > Import > Traffic in GUI or <code>import_traffic</code> CLI tool	Object tables Traffic Tables
Traffic into LSPs	File > Import > Traffic in GUI or <code>import_lsp</code> CLI tool	LSP (object) table Traffic Tables
Growth rates for interfaces or demands on per-object basis	File > Import > Traffic in GUI or <code>import_traffic</code> CLI tool	Object tables Traffic Tables
Growth rates for interfaces or demands based on tags	File > Import > Traffic in GUI or <code>import_growth</code> CLI tool	Object tables Traffic Tables Growth Tables

Import Traffic and Per-Object Growth Rates Using the GUI

-
- Step 1** Choose **File > Import > Traffic**. The Import Traffic dialog box opens.
- Step 2** Import traffic measurements.
- a. In the Traffic File area, select whether to import from a plan or from a table file, and then enter or browse to the plan or table filename you are importing.
 - b. In the Traffic to Import area, select the traffic tables you want to import: interfaces, LSPs, nodes, ports, flows, or demands.
 - If importing interfaces, LSPs, or nodes from a table, specify the columns to use as the table key. For example, for interfaces, select whether to identify the traffic imported based on the IP address or based on a combination of the node and interface name.
 - For flows and demands, the “new” option imports flows or demands that do not exist in the plan file, including their traffic. The “in plan” option imports traffic only for flows or demands that currently exist in the plan.
- Step 3** In the Growth Rates to Import area, select whether to import growth rates for interfaces and demands. This import is on a per-object basis. To import traffic on a per-tag basis, see [Import Growth Rates Based on Tags Using the GUI](#).
- Step 4** In the Traffic Levels area, select whether to import all the traffic levels or a single traffic level. If importing all, the traffic level names are kept on import. If importing a single traffic level when there are multiple levels available, you must specify a name. Optionally, the level can be renamed on import.
- Step 5** To display a plan with the imported information, click **Preview** and then **OK**.
- Step 6** Click **OK**.
-

You can also import demands by creating a demand mesh table and then import it while creating a demand mesh. This is specified by the `-demandmesh-table` option of the `dmd_mesh_creator` tool. The DemandMeshGenerator table provides information on the demand mesh to create. It has the following columns:

- **Endpoint**—Represents the source/destination of a demand. For nodes, this corresponds to the node name. Other types of endpoints can also be specified. For example, 'AS{12345}' is a valid entry for an AS.
- **SrcDest**—Has a value of *Src*, *Dest*, or *both*, which specifies whether to use the endpoint as the source of the new demands, as the destination, or as both.
- **SrcTraffic**—Represents the source traffic (used by the `dmd_traffic_creator` tool).
- **DestTraffic**—Represents the destination traffic (used by the `dmd_traffic_creator` tool).

Import Growth Rates Based on Tags Using the GUI

-
- Step 1** Choose **File > Import > Growth**. The Import Growth dialog box opens.
- Step 2** Select whether to import demand or interface growth rates.
- Step 3** If the interfaces or demands into which you are importing traffic have multiple tags, specify how to apply them.
- Average the growth rate evenly across the tags
 - Add growth rate to each tag
- Example: An interface has two tags: GrowthTrend and ExtraSales. Each tag is listed in the <InterfacesGrowth> table, but Peak has a growth of 10%, whereas Normal has a growth of 5%.
- If averaged, the resulting growth rate is 7.5%.
 - If added, the resulting growth rate is 15%.
- Step 4** Click **Preview** to see how many rows in the growth table apply to the interfaces or demands.
- Step 5** Click **OK**.
-

Demand Grouping Traffic

WAE Design lets you specify traffic growth per demand grouping, which in turn lets you create growth plans that use estimates of aggregate traffic growth. Demand grouping traffic can be entered into WAE Design in several ways:

- Enter the traffic growth into the Demand Grouping Properties dialog box in the WAE Design GUI.
- Import a single period of demand grouping traffic using the Import Demand Grouping Traffic tool.
- Create an external <DemandGroupingTraffic> table and select the option to use this table in the Create Growth Plan GUI tool or `create_growth_plans` CLI tool.

<DemandGroupingTraffic> Table

The <DemandGroupingTraffic> table specifies traffic growth for demand groupings, over one or more periods. You can then import the traffic growth values for a single period or use the entire table to create growth plans for multiple periods.

For More Information...	See...
Create growth plans for multiple periods using the <DemandGroupingTraffic> table	<i>Cisco WAE Design User Guide</i> <code>create_growth_plans</code> Help output
Import single periods of the <DemandGroupingTraffic> table for use in creating growth plans	Import Demand Grouping Traffic Growth <code>insert_demand_grouping</code> Help output

Table Content

Each row in the <DemandGroupingTraffic> table specifies forecasts for a demand grouping that must already exist in the plan file into which this table is being imported. (These demand groupings must exist in a table called <DemandGroupings>.)

WAE Design calculates the expected traffic based on a combination of columns and periods where the <period> variable specifies the time period. [Table 4-9](#) describes the columns; the examples are for the simplest forecast calculation possible where only one column and one period are used.

Table 4-9 **<DemandGroupingTraffic> Columns**

Column Name	Description
DemandGrouping	Name of the demand grouping. This name must exist in the <DemandGroupings> in the plan file into which you are importing the table.
TrafficLevel	Specifies that the growth is to be applied to this traffic level, which must exist in the plan file into which the table is being imported. If not specified, the default is to apply the growth to all traffic levels.
TrafficTotal:<period>	Specifies an exact traffic total in Mbps. If not specified, use the total traffic for the demand grouping of the previous period, or the base plan if this is the first period.
GrowthPercent:<period>	Specifies the percent by which to grow current traffic in Mbps. Example: If traffic total is 40,000 and GrowthPercent is 10, the growth plan grows the traffic to 44,000 Mbps.
TrafficIncrement:<period>	Specifies the amount of traffic to increment by in Mbps. Example: If traffic total is 2600 and TrafficIncrement is 500, the growth plan grows the traffic to 3100 Mbps. Note: If both GrowthPercent and TrafficIncrement are used for the same <period>, the GrowthPercent is applied first.

Traffic Growth Columns and Periods

The TrafficTotal, TrafficIncrement, and GrowthPercent columns let you generate forecasts for multiple time periods, and each column defines a different manner in which traffic will be increased. Each column uses a <period> variable that serves several purposes. See [Example <DemandGroupingTraffic> Table](#).

- The order in which <period> variables appear in the table defines the order in which WAE Design defines the growth plans.
- The <period> names the period being forecasted, for example Q1, and this name is appended to the root filename when new growth plan files are created. (Root filename is the plan file into which you are importing the table.)
- The <period> tells WAE Design which of the columns to combine to calculate the forecast for that one period.

If multiple columns use the same <period> name, WAE Design uses all of those columns to generate one forecast for that <period>. For example, if both GrowthPercent:Q1 and TrafficIncrement:Q1 are defined, then both columns are used in the calculation.

Columns can be (and likely are) repeated, each time with a different <period> variable. For example, if GrowthPercent:Q1 and GrowthPercent:Q2 are both defined, they are used for the creation of two separate plan files.

Traffic Growth Calculations

It is the combination of the columns and their use of <period> that WAE Design uses to generate growth plans, or expected traffic, for the sum of all demands within each demand grouping. For each period associated with a demand grouping the growth plan is determined using the following algorithm. See [Example <DemandGroupingTraffic> Table](#).

-
- Step 1** If TrafficTotal is specified, the expected traffic is set to this value.
- If TrafficTotal is not specified and if this is the first period listed in table, the expected traffic is the total traffic in the demand grouping in plan file into which it is being imported (*base plan*).
- If TrafficTotal is not specified and if this is not the first period, the expected traffic is the total traffic in the demand grouping for the previous period.
- Step 2** If GrowthPercent is specified, the traffic growth is according to this percentage.
- Step 3** If TrafficIncrement is specified, this value is added to the expected traffic after GrowthPercent is applied.
-

Example <DemandGroupingTraffic> Table

[Table 4-10](#) is an example <DemandGroupingTraffic> table. Each row identifies a unique demand grouping in the ACME plan file, together with forecast data for future periods.

- TYO to All demand grouping is forecasted to grow by 1,000 Mbps in Q1 and an additional 5% in Q2.
- SEL to All demand grouping is forecasted to grow by 1,500 Mbps in Q1. In Q2, it is forecasted to grow by 5%, plus an additional 2,000 Mbps.
- PEK to All demand grouping is forecasted to have 5,000 Mbps of traffic in Q1 and grow 6% in Q2.

Table 4-10 Example <DemandGroupingTraffic> Table

DemandGrouping	TrafficTotal:Q1	TrafficIncrement:Q1	GrowthPercent:Q2	TrafficIncrement:Q2
TYO to All		1000	5	
SEL to All		1500	5	2000
PEK to All	5000		6	

Table 4-11 identifies the results of applying this example <DemandGroupingTraffic> table to the ACME plan file. The newly created plan files are named ACME_Q1 and ACME_Q2.

- The Current Traffic column lists the total traffic across all demands in the associated demand grouping. This demand grouping resides in the plan file into which this table is being imported.
- The Q1 Expected Traffic column lists the traffic forecasted for that Q1 period using the rules specified in [Traffic Growth Calculations](#).
Example: SEL to All demand grouping is 1,500 Mbps increment + 3,000 Mbps of existing traffic = 4,500 Mbps.
- The Q2 Expected Traffic column lists the traffic forecasted using these same rules, only this time using Q1 traffic as the basis for calculations.
Example: SEL to All demand grouping is (5% growth of 4,500) + 2,000 Mbps increment = 6,725 Mbps.

Table 4-11 Expected Q1 and Q2 Traffic Growth

Demand Grouping	Current Traffic	Q1 Traffic	Q2 Traffic
TYO to All	2000	3000	3150
SEL to All	3000	4500	6725
PEK to All	4000	5000	5300

Import Demand Grouping Traffic Growth

You can import demand grouping traffic growth information.

- The demand groupings in the current plan must match the names of the demand groups in the <DemandGroupingTraffic> table.
- The file from which you are importing must be a .txt file.

-
- Step 1** Choose **File > Import > Demand Grouping Growth**.
- Step 2** In the **Import from table file** field, enter or browse to the file containing the <DemandGroupingTraffic> table.
- Step 3** To import only traffic for a specific period, enter that Period name and then click **OK**. Alternatively, leave the **Period** field empty, and when you click **OK** you are prompted with a list of periods from which to choose.
-

Representative Plan Files

Plan files are snapshots of a network state at a point in time. Transitory events, such as failures, are captured in the snapshot if they occur during this time. The traffic collected is the specific traffic that occurred during that collection window, which can be five minutes or less. As such, a snapshot usually does not represent the network state over the course of a typical day or week of network operation, and thus, is inadequate to use as the basis for long-term design and planning tasks. To address these needs, the `create_representative_plan` tool uses multiple snapshots from an archive to construct a single plan that is more representative of the general network state.

- The topology is extracted from a base plan, which by default is the most recent snapshot. You can, however, specify any plan file as the base plan.
- The representative plan contains multiple traffic levels, one per time interval specified. For example, there could be one traffic level per hour of the day.
- Demands are extracted from snapshots that are selected from each of these time intervals. A single demand in the representative plan file contains a range of traffic values representative of the different amounts of traffic for that demand over the course of the specified time period.
- Interface, LSP, and node measurements are extracted from snapshots that are selected from each of these time intervals.

A representative plan file is particularly useful when planning networks where peak utilizations occur at unknown or different times of the day across different interfaces. A simulation analysis performed over all traffic levels identifies the time intervals when peaks occur.

You can fine-tune the results to include specified snapshots for multiple traffic levels across specific intervals. These time parameters are divided into two sets.

- One set includes `-time-period`, `-time-interval-length`, and `-time-interval-starts`. These parameters define time intervals during a day or during a week (defined by `-time-period`) that are created for the resulting plan file.
- The other set includes `-sample-time-end`, `-sample-time-length`, and `-time-zone`. These parameters define which periods of data in the archive are used to populate the specified time intervals.

The `create_representative_plan` tool does the following to create the representative plan file:

- Examines all snapshots that fall into the specified time interval during the sample time range. Of these snapshots, WAE Design selects the one with the least number of failed circuits and the most number of active interfaces in the common base plan. If there is a tie, the snapshot with the highest amount of demand traffic is selected. Only snapshots with single traffic levels are used.
- Removes all traffic intervals from the base plan.
- Creates new traffic intervals in the base plan, using the format HHMM-HHMM or DDDHHMM-DDDHHMM, depending on whether the time period is a day or a week.

Examples: 03:00-04:00 and Fri17:00-Fri18:00

- Imports all demands from the corresponding snapshot for the time interval.
 - If a snapshot demand matches one existing in the base plan, then WAE Design uses that demand and the snapshot demand traffic for it.
 - If there is no matching demand, WAE Design creates the demand with 0 traffic.
 - If a demands exists in the base plan, but not in the snapshot, the demand is used with 0 traffic.

Note that multicast demands are imported with the required multicast flows and multicast destinations.

- Imports measured traffic for interfaces, LSPs, and nodes that exist in both the base plan and the snapshot.

Each representative plan file includes a report section where each traffic level is defined per row.

Examples

In this first example, the network peak time is between 4 PM and 7 PM daily. To better understand this peak traffic, we could create a representative traffic level for each hour of this range, which includes 4 PM, 5 PM, and 6 PM. For weekly forecast purposes, we are interested in sampling the last 5 days to construct the traffic levels. We are naming the output file “representative_day.pln.” We are choosing to use the latest snapshot in the time period, 110502_0347.UTC.pln, as the base plan, and it is located in the archive that is named “backbone.” See the following command and sample output:

```
create_representative_plan -out-file representative_day.pln -archive backbone
-time-interval-length 60 -sample-time-length 1 -time-interval-starts 1600,1700,1800
```

Traffic Level	Snapshot	Matching Interfaces	Total Demand Traffic	Total Demands	Demands Not Imported
16:00-17:00	110502_0347.UTC.pln	25	43534.32	453	4
17:00-18:00	110502_0347.UTC.pln	25	47583.23	454	3
18:00-19:00	110502_0347.UTC.pln	25	50771.49	454	3

In this second example, we know the network peak times are around 4 PM daily, as well as 8 PM on Fridays. We need to get a representative traffic level for each of these six periods for the last two weeks. Today is Tuesday, so yesterday’s 4-5 PM range and last week’s Monday 4-5 PM range are used to construct the 4 PM traffic level. The name of the representative plan file we are creating is “weekly_peak.pln.” The base plan, 110407_0423.UTC.pln, is in the acme directory. See the following command and sample Traffic Levels output:

```
create_representative_plan -plan-dir acme -base-plan 110407_0423.UTC.pln -outfile
weekly_peak.pln -time-period week -time-interval-length 60 -sample-time-length 14
-time-interval-starts Mon1600,Tue1600,Wed1600,Thu1600,Fri1600,Fri2000
```

Traffic Level	Snapshot	Matching Interfaces	Total Demand Traffic	Total Demands	Demands Not Imported
Mon16:00-Mon17:00	110407_0423.UTC.pln	97	53245.14	6702	21
Tue16:00-Tue17:00	110407_0423.UTC.pln	97	53413.36	6702	21
Wed16:00-Wed17:00	110407_0423.UTC.pln	95	49985.27	6701	22
Thu16:00-Thu17:00	110407_0423.UTC.pln	97	56831.91	6702	21
Fri16:00-Fri17:00	110407_0423.UTC.pln	93	48732.18	6700	23
Fri120:00-Fri21:00	110407_0423.UTC.pln	97	53692.39	6702	21

