Yearly update of the LRAIC model for fixed networks in Denmark

Danish Business Authority

Ref: 2012-55-DB-DBA - Fixed LRAIC

TERA Consultants
39, rue d'Aboukir
75002 PARIS
Tél. + 33 (0) 1 55 04 87 10
Fax. +33 (0) 1 53 40 85 15
www.teraconsultants.fr

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Summary

0 Introduction

TDC's network and customer base evolve every year. In order to capture the evolution of costs per customer, new inputs are gathered every year in order to update the LRAIC models.

To facilitate the annual updates of the LRAIC core and access network cost models, an Excel update file has been created. This file gathers all data that should be provided by TDC except for leased lines information. Leased lines information has to be updated in a separated file since this information is confidential.

This document describes the data needed to update the model and where/how this traffic is measured in TDC's network. It furthermore explains how the yearly update of the model should be performed. First part of the document focuses on the LRAIC regulated services where the second part focuses on the leased lines.

1 Structure of the Yearly Update file

The Yearly update file is composed of eight input spreadsheets (in grey), two summary spreadsheets (in blue) and two interface spreadsheets (in green). Black spreadsheets are annexes.

The eight input spreadsheets (in grey) are:

- Voice traffic;
- Broadband traffic + E transport;
- TV (IPTV) ;
- VOD ;
- CATV ;
- Subscribers ;
- Customers speed ;
- Colocation – Other

These are the sheets that need to be update annually.

The summary spreadsheets are named “New data - Core” and “New data - Access” and the interface spreadsheets are named “Historical inputs - Core” and “Historical inputs - Access”. The interface spreadsheets make it possible to cross check the new inputs with the previous years and identify any non-intuitive evolution of the new data.

Input spreadsheets gather all the data required for the specific year that has to be updated. All the input information is re-ordered and summarized in the spreadsheets “New Data”.

The former model was updated yearly based on actual data for the first half year of the current year and a forecast for the second half of the current year. So for instance, prices for 2014 were based on actual data for first half year 2013 and forecast data for second half year 2013. The forecast for H2 2013 was made by multiplying data from H2 2012 with the observed growth rates from H1 2012 to H1 2013.

DBA believes that this method was quite arbitrary and mechanic, and will therefore suggest not using forecast data. Data in the new model will therefore be the actual data for the second half year of the previous year and actual data for first half year of the current year (prices for 2015 will be based on actual data for second half year 2013 and actual data for first half year 2014).

In order to have subscriber base inputs that are representative of the average count of the period defined above, DBA considers that the subscriber base should be provided as of the end of the previous year (prices for 2015 will be based on actual traffic data

for second half year 2013 and actual data for first half year 2014 so customer base as of end of 2013 should be provided).

It should be noted that when DBA requires monthly traffic measurements, half-year measurements could be envisaged in the future if evolution on a month-by-month basis appear to be almost flat.

Further explanations on the specific data in each spreadsheet are provided below.

1.1 Voice traffic

This spreadsheet gathers information regarding voice traffic in the network for the last 12 months (H2 of the year before and H1 of the current year).

Traffic measure

The number of minutes and number of calls should be provided for PSTN for the following services[1]:

- On-net;
- IN;
- International – Incoming;
- International – Outgoing;
- International – Transit;
- Incoming fixed off-net;
- Originated prefix traffic
- Transit - Local interconnection;
- Transit - National interconnection;
- Outgoing off-net;
- Incoming Mobile to fixed;
- Incoming Mobile to Outgoing International.

As regards VoIP, the total number of minutes and number of calls should be provided along with the total number of minutes and calls for the following services:

- Voice – On-net
- Voice - International – Outgoing

[1] DBA takes the view that even though some of these traffic categories have very similar routing, these should be considered apart in order to properly identify the termination traffic for the fixed termination rate calculation.

- Voice - Outgoing off-net

TDC explained that performing measures for remaining VoIP services is not manageable at this stage. As a consequence, DBA considers that the remaining traffic[2] should be split between services based on the PSTN split.

Monthly information is aggregated for each half year. Figures should include the resold traffic on TDC's network. TDC has informed DBA that the data is based on the tariff telegram collected in TDC's statistical program TOT.

Peak to mean ratio measure

TDC has explained that measuring peak to mean ratios for each voice direction is not possible with TDC's current monitoring systems. Furthermore, TDC has no data to distinguish between PSTN and VoIP. As a consequence, a single peak to mean ratio for voice is provided for all services based on the VOIP technology (as the future used technology). TDC has suggested measuring the VoIP peak to mean ratio on the IMS site at "Borups Alle" (which is the largest IMS site in TDC's network).

TDC has given DBA the following information regarding the measurement of the peak to mean ratio:

"*At TDC's network elements (Routers, Switches, etc.), a MIB (management Information Base) is installed and it is accessed by a SNMP protocol. Selected data (including the traffic Bytes and the number of packets) from these MIB are downloaded and saved in a Remie system as Round robin databases. Selected data from Remie is visualized as graphs over an optional period and can show the incoming and outgoing traffic across an interface in the network. Peak mean ratio for Voice can be made by selecting downstream max traffic and downstream average traffic graphs for a given month. The two traffic readings are divided to get a Peak Mean conditions.*"

DBA believes that the traffic measured at the IMS at Borups Alle is a good proxy for the traffic generated at the IMS sites in the model as it has a sufficient number of customers to be representative for an average IMS in the model.

1.2 Broadband traffic + E-transport

This spreadsheet gathers information regarding broadband traffic in the network for the last 12 months (H2 of the year before and H1 of the current year):

- Broadband traffic;
- Broadband peak to mean ratio;
- Broadband BH traffic for CATV.

[2] Difference between the total traffic and the sum of the traffic of the 3 services TDC is in a position to measure.

Traffic measure

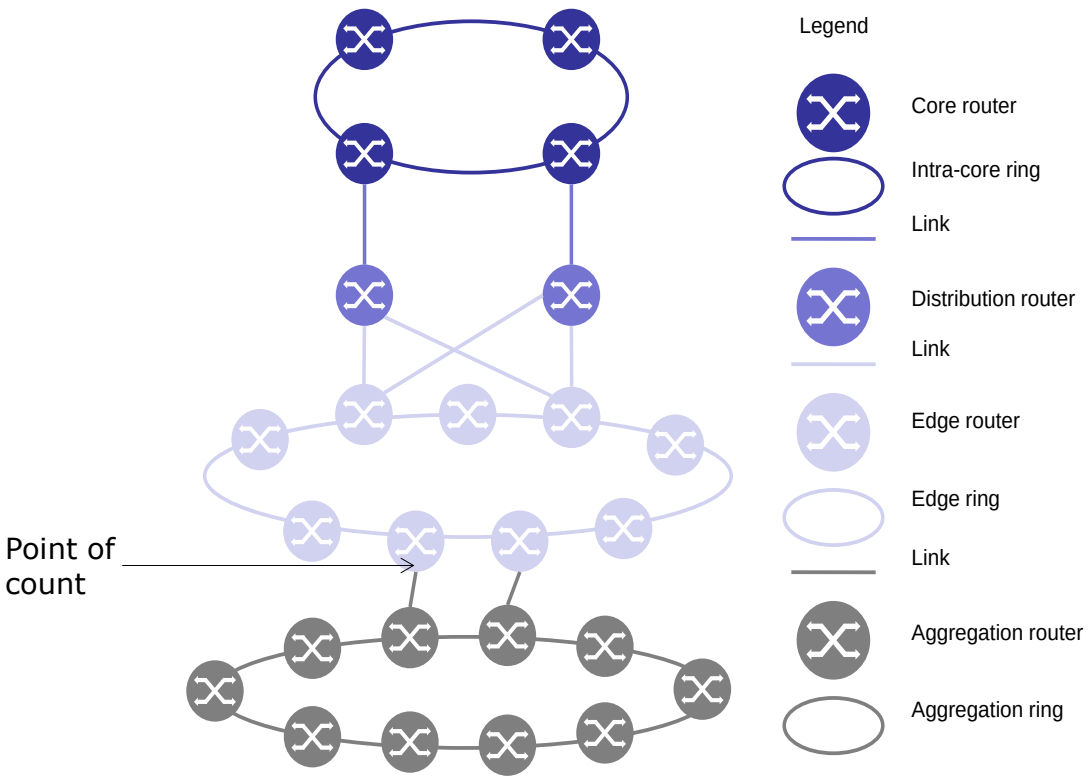
The monthly consumption per customer is requested for the following services:

- TDC Broadband
- VULA/BSA (DSLAM / Layer 2 / Layer 3)
- Ethernet transport - national

TDC Broadband

TDC has informed DBA that the broadband traffic (TDC internal and resold) is measured at the edge router level[3] (see Figure 1). On this interface, the traffic from the Broadband service is terminated, i.e. the traffic volume on these interfaces "mirrors" the traffic on the DSLAM ports, which means that no traffic is lost or added on the path from the DSLAM port to the IP termination IF.

Figure 1 - Broadband traffic measure



Source: TDC

[3] It is measured at the IF on the juniper M320/MX960 router, where the VLANs containing "Broadband" traffic is identified. i.e the traffic is aggregated over several Ifs/Nodes. The traffic is "unchanged" from the MSAN to the IP termination point. The traffic continues to the core, to a vast extend.

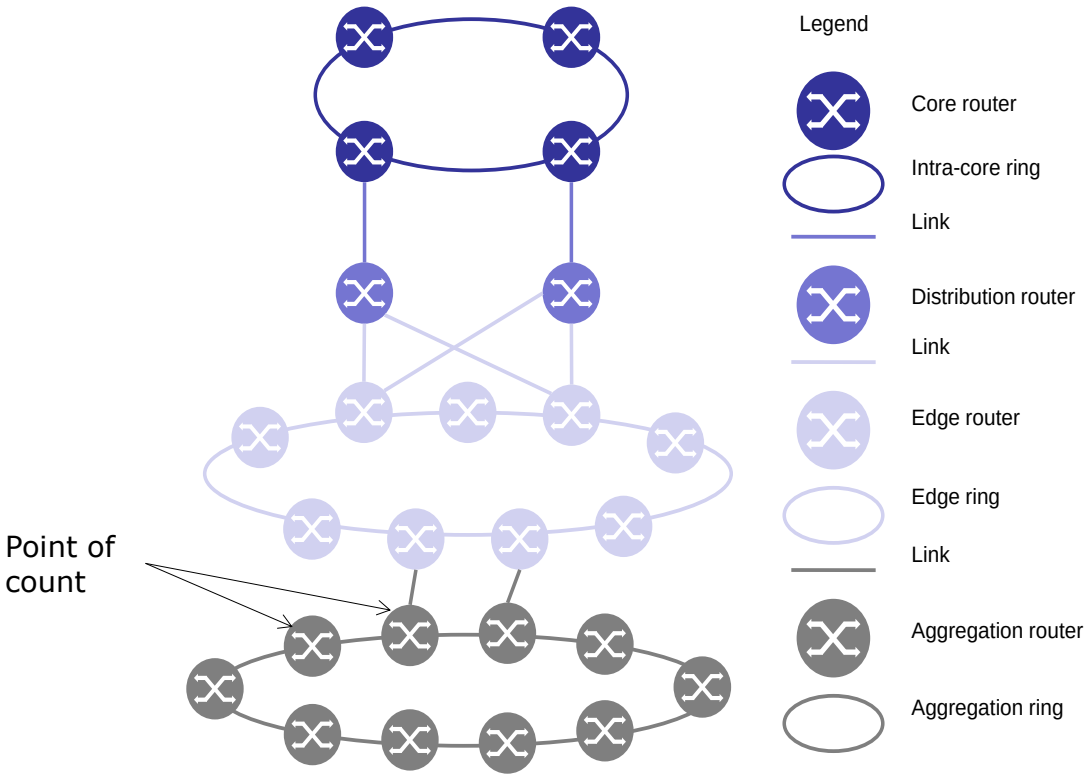
In order to get the graph, a MIB (management Information Base) is installed at the point of count and is accessed by SNMP protocol. Selected data (including the traffic Bytes and number of packets) from these MIB is downloaded and saved in Remie system as Round robin databases. From Remie, data is copied and stored as raw data that can be processed using SAS software. MIB information from all the interfaces (logical or physical) on the edge of the IP network (originally at the L3 node) where traffic from xDSL is terminated are selected (only from TDC's retail and resold products). The traffic is summed for each half year and divided by 6 and divided by the reported number of xDSL customers.

The broadband peak to mean ratio is measured at the network level indicated in figure 1. TDC has informed DBA that for historical reasons, TDC builds its broadband peak to mean ratio calculation on a graph that can be described as follows:

At TDC's network elements (Routers, Switches, etc.) a MIB (management Information Base) is installed and is accessed by SNMP protocol. Selected data (including the traffic Bytes and number of packets) from these MIB are downloaded and saved in Remie system as Round robin databases. Selected data from Remie (including the traffic Bytes and number of packets) is visualized as graphs over an optional period that can show the incoming and outgoing traffic across an interface in the network and the observed period average of incoming and outgoing traffic can be read. Peak mean ratio of BB is made by choosing graphs of TDC's retail xDSL residential market customers in a given month. Downstream max traffic and downstream average traffic are read. The peak to mean ratio is obtained by dividing the two graphs.

The BSA traffic is counted on all the interfaces (IFs) where the BSA operators have the PoI, regardless of POI type. The traffic is aggregated over all IFs on which BSA traffic is interconnected (see Figure 2).

Figure 2 – BSA traffic measure



Source: TDC

TDC has submitted the number of BSA customers as one aggregated number and as a consequence, TDC has measured the traffic on all BSA customers at the edge layer to capture a traffic volume that correspond the total number of customers.

Only the peak to mean ratio for TDC's internal customers has been measured. It has been assumed that the peak mean ratio for BSA (external customers) is the same.

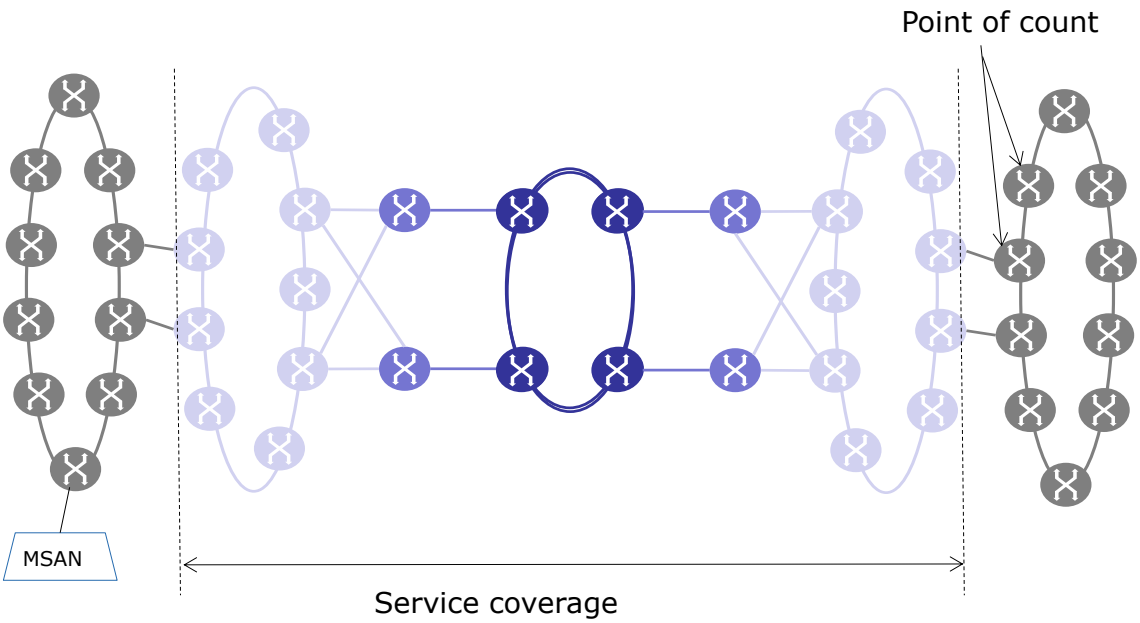
DBA will not suggest changes for the update of the model for 2015. However, for the following updates DBA would ask TDC to perform a common measurement of the traffic and peak mean ratio for both internal and external customers (residential and business).

Ethernet transport traffic is counted on all the IFs where the BSA-operators that use the "Ethernet transport service", interconnect the traffic (see Figure 3). The traffic is aggregated over several IFs. It is in the "interconnection-end" that the traffic is counted.

At TDC's network element (Routers, Switches, etc.), a MIB (management Information Base) is installed and is accessed by SNMP protocol. Selected data (including the traffic Bytes and number of packets) from these MIB are downloaded and saved in Remie system as Round robin databases. Selected data from Remie is visualized as graphs over an optional period and shows the incoming and outgoing traffic across an interface in the network and the observed period average of incoming and outgoing traffic can be read. In a similar manner graphs of groups of interfaces can be visualized. Based on the information on Interface type and customers, the appropriate

ports for EBSA transport can be identified. The traffic is identified for each month and read: Down max traffic and Down average traffic.

Figure 3 – Ethernet transport traffic measure



Source: TDC

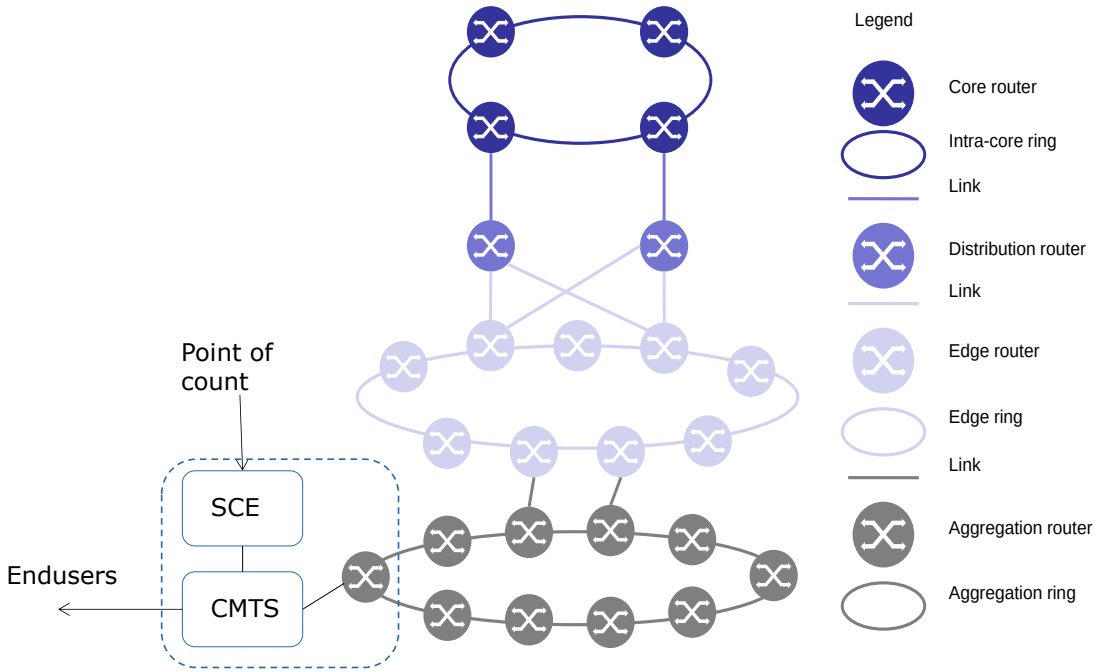
CATV Broadband BH traffic

TDC has informed DBA that:

"The traffic statistics for the Docsis based broadband are collected via the Cisco Insight system. The traffic load is monitored (deep packet inspection) through SCE's (Service control engine) on the CMTS sites (see Figure 4). In the current technical setup, these are not available at all CMTS sites. As a consequence, the measure is performed on Fyn only (this site is considered by TDC as a valid proxy for nationwide behaviour). Afterwards this traffic measure is scaled to the whole country on basis of the broadband subscribers on Fyn compared to the country total.

From the Cisco insight system the data is collected for one week in the first whole week in February, May, August and November. The Busy quarter is identified, and the downstream and upstream traffic load is read (in Gb/s). The broadband subscriber volumes for Fyn and Country total are collected from the Jaipur system."

Figure 4 – Coax broadband traffic measure



Source: TDC

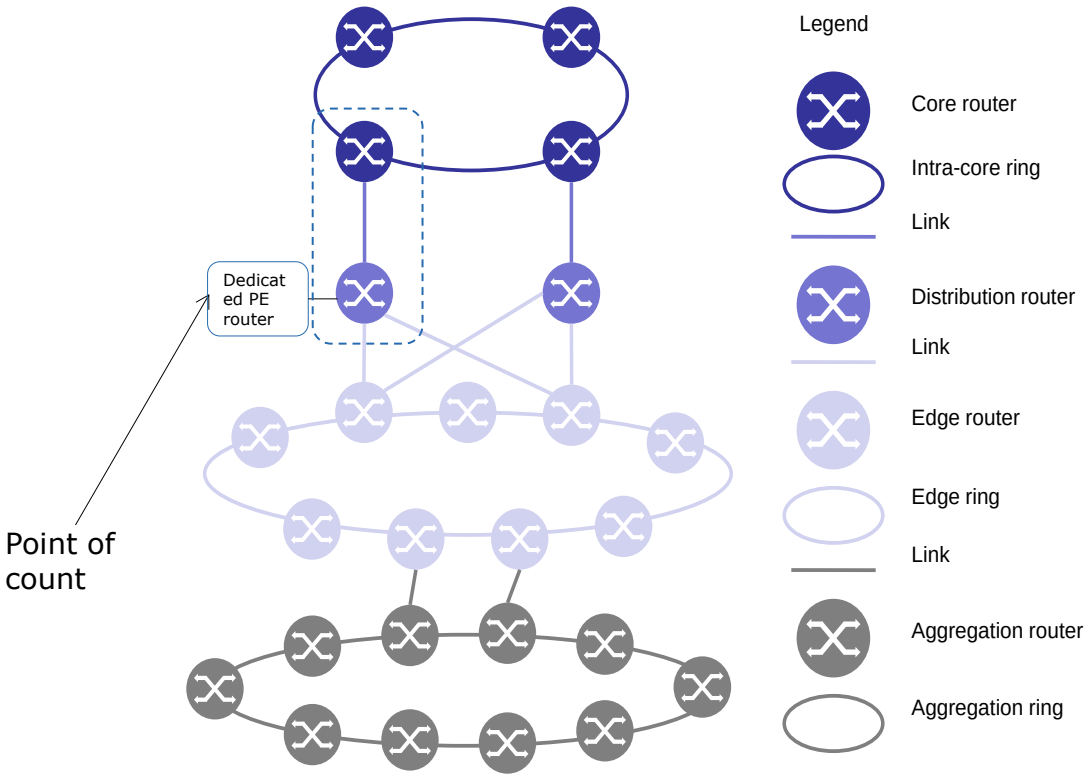
1.3 IPTV

This spreadsheet collects the information required to estimate the IPTV traffic for the last 12 months (H2 of the year before and H1 of the current year) transiting on the TDC network, for copper, fibre and coax customers.

TDC has informed DBA that:

"The IP TV traffic is estimated by counting the number of TV channels in TDC's TV product portfolio, distinguishing between SD and HD. The number of channels is multiplied with the average bandwidth of a single channel in the multicast stream (across SD and HD). The bandwidth of each channel in the multicast stream is read at the feeding point at the distribution router on Borups Alle (BOA). From here, the IPTV based multicast traffic flows in to the whole network, and the YouSee based multicast traffic will flow into parts of the network" (see Figure 5)

Figure 5 – Multicast traffic measure (TDC IP Tv and Yousee)



Source: TDC

At TDC's network elements (Routers, Switches, etc.) a MIB (management Information Base) is installed and is accessed by SNMP protocol. Selected data (including the traffic Bytes and number of packets) from these MIB are downloaded and saved in Remie system as Round robin databases. Selected data from Remie is visualized as graphs over an optional period can show the incoming and outgoing traffic across an interface in the network and the observed period average of incoming and outgoing traffic can be read.

At interfaces, where there is injected an IPTV-channel in the multicast stream, the bandwidth of the channels' load on the network is measured. The total multicast capacity in the network is calculated by multiplying the number of offered TV channels with the average bandwidth per channel that are injected in the multicast stream. All channels are measured in order to calculate the average bandwidth.

The capacity used by YouSee for multicast distribution in TDC's IP network is calculated by summing the size (Mbps) of each of the individual multicasted channels. The number of TV-channels and the size of each of these is known by YouSee. Hence, the capacity can be calculated precisely. That is, the data is not directly measured. As YouSee's channel offering changes and devotes more capacity in the network to multicast distribution, the data is recalculated.

The multicast traffic to YouSee is an estimate of the capacity used by YouSee for multicast distribution in TDC's IP network."

For the future updates, DBA would ask TDC to submit the average bandwidth for all the SD and HD channels (and not a sample).

1.4 VoD

This spreadsheet collects the information required to estimate the VoD traffic transiting on the TDC network for the last 12 months (H2 of the year before and H1 of the current year). It includes the average traffic per customer, the number of customers (as of end of previous year) and the peak to mean ratio.

The information below is based on information from TDC.

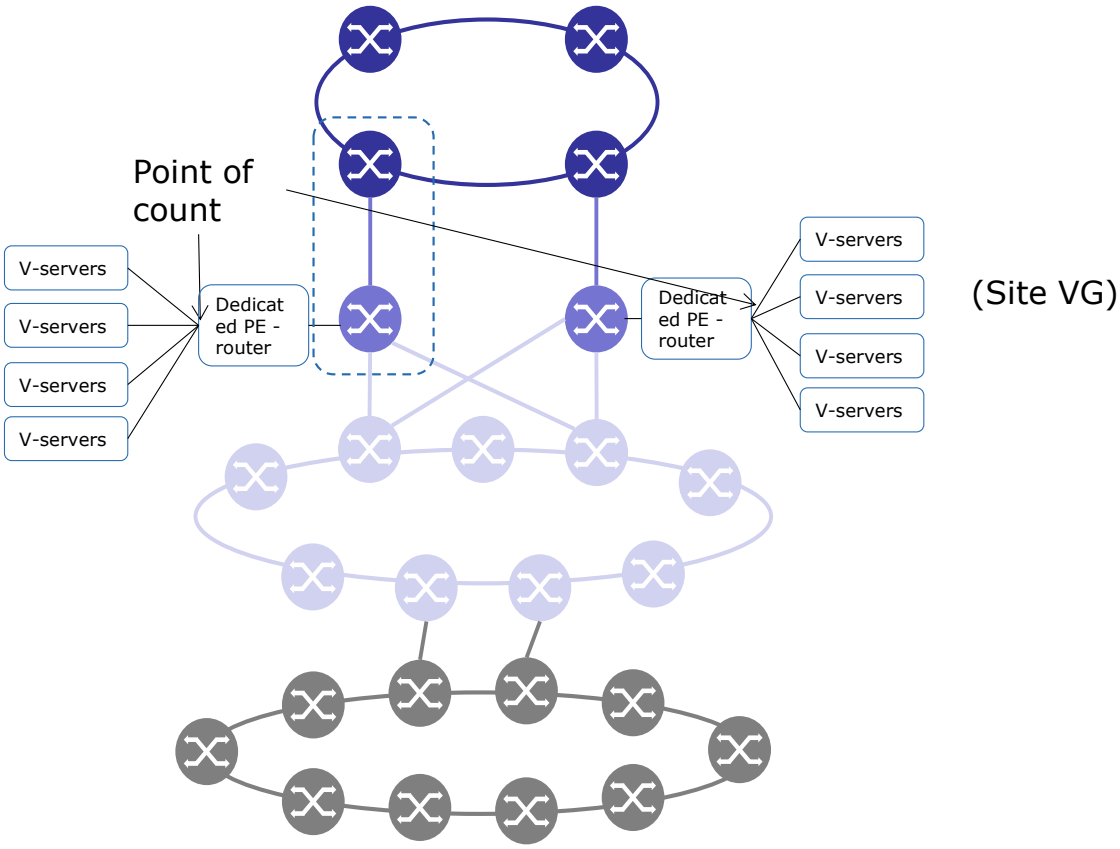
VoD Traffic

The VoD traffic is counted at the distribution routers at 4 sites (VG, AR, ALB, KHK – see **Figure 6**). From here, the traffic flows into the network, potentially affecting all layers. The traffic is aggregated from all the V-server interfaces and sent to all the IPTV-subscribers.

At TDC's network elements (Routers, Switches, etc.), a MIB (management Information Base) is installed and is accessed by a SNMP protocol. Selected data (including the traffic Bytes and number of packets) from these MIB is downloaded and saved in Remie system as Round robin databases. From Remie, data is copied and stored as raw data that can be processed using SAS software.

The traffic is aggregated for each half year and middle speed is calculated as: Half year Traffic * 2 / 365.25 / 24 / 3600 / 8. The traffic is hereafter divided by the reported number of IPTV-customers.

Figure 6 – VoD traffic measure



Source: TDC

VoD subscribers

The number of VoD customers on the copper/FTTH network is the number of customers who have access to use the VoD service. These customers equal the number of IPTV-customers. These can be more or less active through the half year. TDC should report the number of subscribers at the end of the previous year.

VoD Peak to mean

At TDC's network elements (Routers, Switches, etc.), a MIB (managemnet Information Base) is installed and is accessed by a SNMP protocol. Selected data (including the traffic Bytes and number of packets) from these MIB is downloaded and saved in Remie system as Round robin databases. Selected data from Remie is visualized as graphs over an optional period can show the incoming and outgoing traffic across an interface in the network and the observed period average of incoming and outgoing traffic can be read. Peak mean ratio for VoD is made by selecting a graph of TDC's IP TV VoD feeding, in a given month and read Upstream max traffic and Upstream middle traffic. The two traffic readings divided out to a Peak Mean conditions.

1.5 CATV

This spreadsheet gathers information regarding frequency allocation and TV-channels in TDC's CATV network at the end of current half year.

It should be noted that this section could be subject to changes following the specific pricing of TV that is not yet decided.

1.6 Subscribers

This spreadsheet summarizes the number of subscribers for each copper, CATV and fibre service in order to estimate the number of active lines in the network at the end of the year before (representative of the average figure for the period H2 of the year before and H1 of the current year). The number of sites offering vectoring, the number of ADSL and VDSL cards and the number of addresses connected to a remote DSLAM should also be filled.

PSTN/ISDN

PSTN and ISDN number of customers is calculated from the statistical system 'Columbus'[4].

This category includes resold subscriptions since these customers impact the network in the same way as TDC's internal customers

The number of customers should be provided at the end of the previous year.

Broadband customers without a PSTN line

ADSL customers are derived from the Columbus database run together with AdMAn[5].

CATV customers are derived from CASPAR/MIR systems.

The number of customers should be provided at the end of the previous year.

VULA/BSA

The number of customers is calculated from the statistical system 'Columbus'. BSA-operators interconnecting to TDC are inputted. In addition, Fullrate (a TDC subsidiary) is included since these customers are connected to a third party transport network.

The number of customers should be provided at the end of the previous year.

1.7 Customers speed

This spreadsheet gathers information regarding distribution of customers on different speeds traffic in the network for the end of the previous year. This information is used

[4] Colombus is a customer order management system provisioning / planning, pricing, etc

[5] AdMan is a provisioning system where the underlying production technology is specified.

to differentiate BSA/VULA prices on the different speeds for respectively copper and fiber.

1.8 Colocation - Other

Given the number of colocation services, TDC has stated that it was not manageable to provide the demand for each of these services. As these volumes are used only to compute the total cost of these services, TDC is asked to provide directly the total yearly revenue due to all these services.

2 Update of the model

The column “I” of the spreadsheet ““New Data core” and “New Data access” contains all information necessary for updating the model. This column should be copied in the interface spreadsheets that keep the history of former yearly updates (column “I” can simply be directly copied and pasted from the “New data – XXX” tab to the “historical inputs – XXX” tab at once).

The interface spreadsheets have a similar structure as the LRAIC models in order to allow a direct copy-paste. The “Historical inputs - core” sheet is the exact same sheet as the “Historical inputs” sheet from the core model. Once the “Historical inputs - XXX” sheets from the annual update file contain new data, the columns “I” to “S” can be pasted in the columns “I” to “S” in the corresponding spreadsheets in the models.

3 Leased lines update

The leased lines data is gathered in the file ‘2012-55-DB-DBA-Fixed LRAIC-Leased Lines.xlsb’.

The leased line busy hour traffic should be updated in the spreadsheet ‘Parameters’:

- Cell ‘B2’ should be updated with TDC 'IP via Fibre' traffic measured at the aggregation level. The traffic should be provided in Gbps;
- Cell ‘B7’ should be updated with TDC 'IP via LL' traffic measured at the aggregation level. The traffic should be provided in Gbps.

These two values are used to compute the contention ratio of the ‘IP via Fibre’ service and the contention ratio of the ‘IP via LL’ service.

The three spreadsheets ‘SDH - ID extraction’, ‘IP via LL - ID extraction’ and ‘IP via fibre - ID extraction’ have to be updated. These spreadsheets contain the data regarding each leased line. Each row contains the data regarding one leased line.

The data regarding SDH leased lines should be updated in the spreadsheet ‘SDH - ID extraction’:

- Column ‘B’ is not needed (but kept to be in line with former template);
- Column ‘C’ should contain the bandwidth in Mbps;
- Column ‘D’ is not needed (but kept to be in line with former template);
- Column ‘E’ is not needed (but kept to be in line with former template);
- Column ‘F’ should contain the CO ID of where the starting point of the leased line is located. The CO ID should be chosen among the list of IDs located in column ‘D’ of the spreadsheet ‘Topology’;
- Column ‘G’ should contain the CO ID of where the ending point of the leased line is located. The CO ID should be chosen among the list of IDs located in column ‘D’ of the spreadsheet ‘Topology’.

Column ‘F’ and ‘G’ are used to compute the traffic propagation in the network: knowing where it starts, where it ends and the network topology, i.e. how the different nodes are linked together, it is possible to compute exactly the traffic generated in each node.

The data regarding IP leased lines should be updated in the spreadsheet ‘IP via LL - ID extraction’:

- Column ‘B’ is not needed (but kept to be in line with former template);
- Column ‘C’ should contain the edge router name. It should be provided in one of the following format:
    - ‘ID’&‘nx’&‘…’. E.g.: ‘fhnxt2’ where ‘ID’=’fh’ then ‘nx’ then ‘t2’;
    - ‘ID’&‘nqp’&’…’. E.g.: ‘alb2nqp7’ where ‘ID’=‘alb2’ then ‘nqp’ then ’7’;

  - The ID, in both cases, should be chosen among the list of IDs located in column ‘D’ of the spreadsheet ‘Topology’;

- Column ‘D’ is not needed (but kept to be in line with former template);
- Column ‘E’ is not needed (but kept to be in line with former template);
- Column ‘E’ should contain the interface capacity. It should be provided in kbps.

The data regarding IP via Fibre should be updated in the spreadsheet ‘IP via Fibre - ID extraction’:

- Column ‘B’ is not needed (but kept to be in line with former template);
- Column ‘C’ should contain the information whether the leased line is local or not. A local leased line is a leased line that does not enter a MDF. If the leased line is local, the column should be filled with the keyword ‘Local’ otherwise it should be left empty;
- Column ‘D’ is not needed (but kept to be in line with former template);
- Column ‘E’ is not needed (but kept to be in line with former template);
- Column ‘F’ should contain the sum of capacity on underlying VLANs. It should be provided in kbps;
- Column ‘G’ is not needed (but kept to be in line with former template);
- Column ‘H’ is not needed (but kept to be in line with former template);
- Column ‘I’ is not needed (but kept to be in line with former template);
- Column ‘J’ should contain the CO area name spec 24. It should be chosen among the list of IDs located in column ‘D’ of the spreadsheet ‘Topology’.

For the ‘IP via Fibre’ and ‘IP via LL’ services, the ending point was not available. The traffic propagation computed for the SDH leased lines has instead been used.

The output of the leased lines model is located in the spreadsheet ‘Output per CO’. The values located between the cells ‘C5’ and ‘J1187’ should be copied and pasted in values into the spreadsheet ‘Leased Lines’ in the cell ‘J13’ of the core network cost model.

The leased lines traffic at each level of the network is then assessed bottom-up in by the model.

It should be noted that for new active street cabinet/exchange, TDC should provide the parent exchange ID as new active street cabinet cannot be included in the model.