Data Analytics Based Origin-Destination Core Traffic Modelling

F. Morales*, M. Ruiz, and L. Velasco

Morales, F., M. Ruiz, and L. Velasco. "Data analytics based origin-destination core traffic modelling." In *Transparent Optical Networks (ICTON), 2017 19th International Conference on*, pp. 1-4. IEEE, 2017.

Abstract

In this paper, authors proposed a series of modules to bring data analytics to the core Virtual Network Topology (VNT) and allow Origin Destination(OD) traffic modelling. Specifically, a machine learning procedure is proposed to automatically fit artificial neural network(ANN) models to **predict OD traffic**.

Motivation

➢ Observe-analyse-act (OAA)

To avoid the large overprovisioning given by **statically** managing the VNT to cope with dynamic traffic scenario, network operators need efficient architectures to **dynamically** adapt the VNT in a cost efficient manner. In that regard, including data analytics to enable the OAA loop in the network is presented as a promising option.

GENERIC MODULES TO BRING DATA ANALYTICS TO THE NETWORK

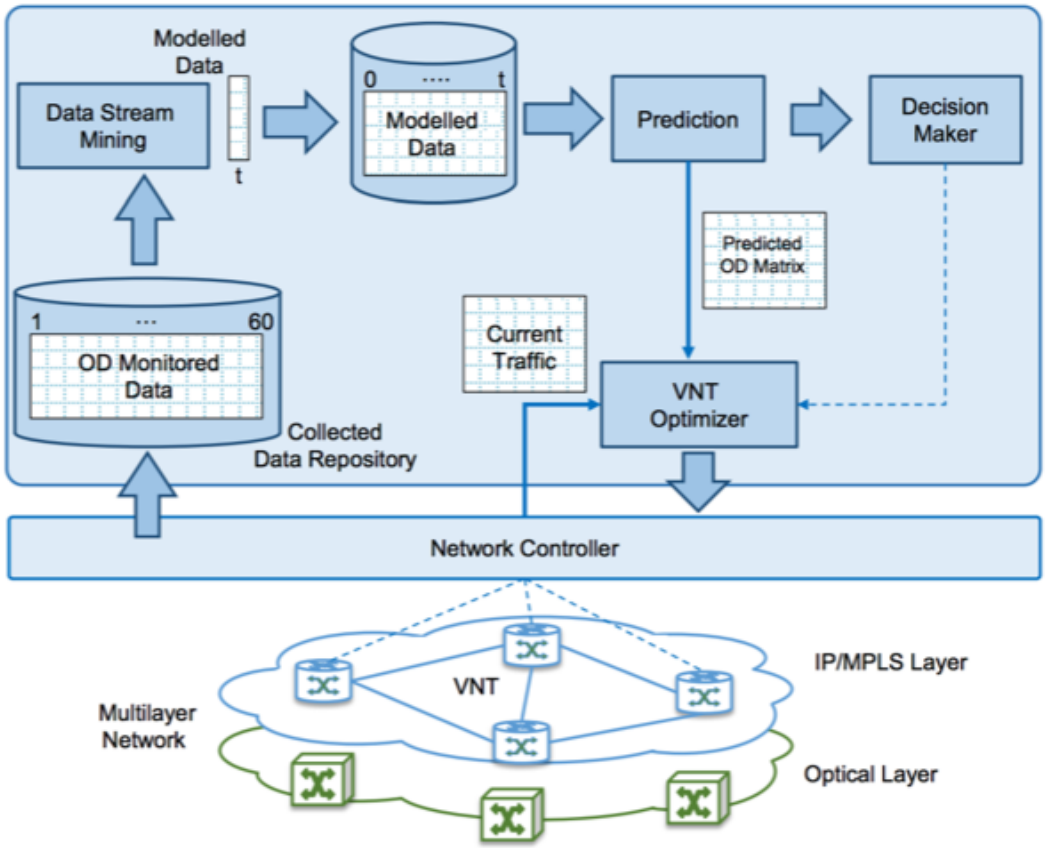


Figure 1. Applying the observe-analyse-act loop for VNT reconfiguration.

These modules allow monitoring traffic, modelling the
monitored data to obtain accurate traffic predictions which are finally used to guide a decision making process responsible for VNT reconfiguration.

GENERIC MODULES TO BRING DATA ANALYTICS TO THE NETWORK

- Every edge router collects a set of samples for the traffic to every other destination router, which is stored in a collected data repository
- Following a predefined time period, a time series from the collected data repository is retrieved for each OD pair and modelled. Modelled data includes, for every OD the minimum, maximum, average, and last collected bitrate measurement within the elapsed time.
- The set of modelled variables for the current period *t* is stored in a repository together with variables belonging to previous periods. A *prediction module* based on machine learning techniques generates OD traffic predictions for the next period; these predictions are used by a *decision maker* module to enable data analytics-based decision making.

MACHINE LEARNING PROCEDURE FOR TRAFFIC PREDICTION

To obtain the maximum traffic prediction at time t, each artificial neural network (ANN) is evaluated with p previous maximum bitrate measurements of the corresponding OD pair from the modelled data repository. Note that considering the maximum instead of average bitrate allows adapting the VNT to the maximum expected traffic hence, ensuring a better grade of service.

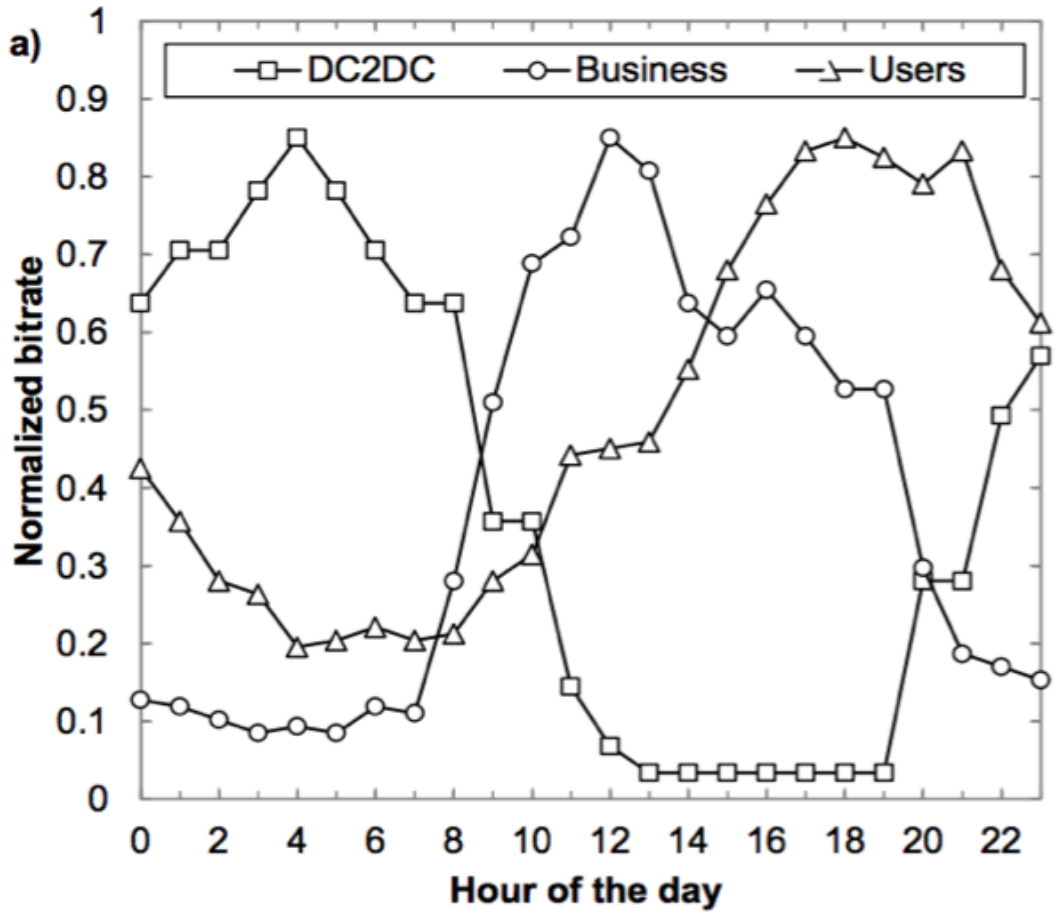
ANN is selected because of its inherent capability ofadapting to traffic changes in a non-supervised manner

Based on the predicted traffic, the decision maker might triggera reconfiguration action of the VNT

SIMULATION RESULTS

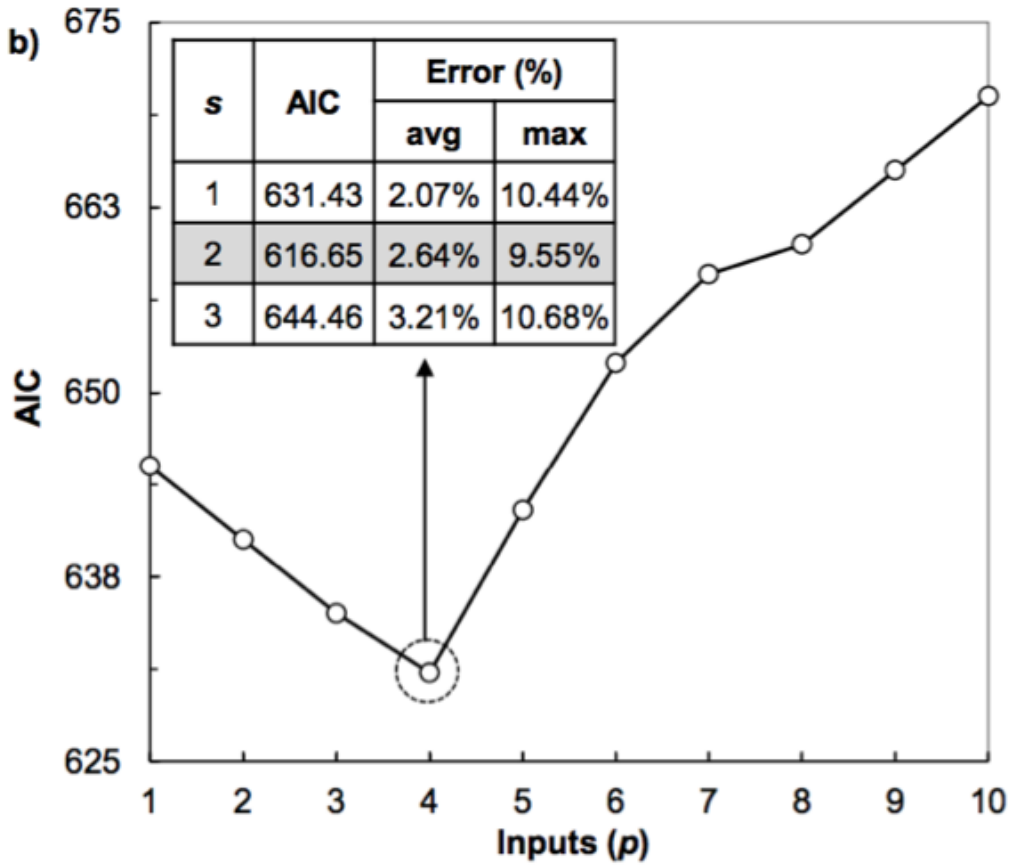
- Traffic Profiles : Users, Business and Datacenter-to-Datacenter (DC2DC).
- The Users traffic profile represents thousands of aggregated multimedia-like connections such as video streaming, with high variability and a traffic peak at noon hours. The Business traffic profile is similar to Users', but with the traffic peak shifted toward midday, at central business hours. Finally, the DC2DC traffic represents tenths of inter-datacenter connections performing scheduled tasks such as database synchronization; for this reason, it presents a lower variability and predominates at night.

SIMULATION RESULTS



Average daily traffic profiles used in the simulation

SIMULATION RESULTS



s	AIC	Error (%)	
		avg	max
1	631.43	2.07%	10.44%
2	616.65	2.64%	9.55%
3	644.46	3.21%	10.68%

ANN goodness of fit

Akaike Information Criterion (AIC)

-is an estimator of the relative quality of statistical models for a given set of data.

Conclusion

- OD traffic in the core VNT can be monitored and analysed to extract knowledge about the traffic that facilitates operating the network
- By applying machine learning techniques, raw data is analysed and meaningful features about the traffic extracted. This richer, modelled data is processed by a prediction module which finally produces OD traffic predictions
- Predicted OD traffic can be used to guide a decision maker in the process of VNT adaptability, adapting the VNT to future traffic matrices or traffic anomalies.