

# Payment model for the Danish National Research and Education Network (Forskningsnettet)

Version 2019-01

This document is an appendix to “Terms for connection to Forskningsnettet” and definitions etc from this document are also used here.

The Danish National Research and Education Network (Forskningsnettet) is a range of services provided to the connected institutions, including network infrastructure, internet traffic to the other research networks in the world as well as general internet, security services, and a range of other services that supports communication and collaboration. For a number of years, these services have been financed exclusively by payments from the connected institutions. The extent of the service portfolio is decided by the DeiC board of directors.

It the aim of the payment model to ensure the sharing of the costs of Forskningsnettet in as fair a ways as practically possible between the connected institutions. Fairness can be many things, and over the years, various allocation keys have been used, such as traffic volumes, international traffic and connection capacities. Since more than 10 years, however, the main principle has been distribution of cost according to the economical size of the institutions, supplemented by minor corrections for institutions with several locations.

The details of the payment model are as follows:

## 1. Distribution according to turnover

The network connected institution pays a contribution to Forskningsnettet, which is proportional to the turnover of the institution the previous year. The turnover is here defined as the sum of ordinary expenditures in the annual report of the institution. The proportionality factor  $f$  is calculated every year as the ratio between the costs of Forskningsnettet to be shared in the budget  $E$  of the year and the sum of turnovers  $e_i$  of the network connected institutions from the previous year:

$$f = \frac{E}{\sum_{all} e_i}$$

For a number of years, DeiC has sought to keep this factor around 1.5%.

When the turnover used in this model is determined, it is possible to adjust it in cases where it is not the whole institution that uses Forskningsnettet. The payment of the Carlsberg Laboratories is for instance not calculated based on the turnover of Carlsberg as a whole. The payment  $p_i$  of a network connected institution is then calculated as  $p_i = f \cdot e_i$ .

For institutions with only one geographical location connected to the network, this is what needs to be paid and the following section is therefore not relevant for such an institution, except that the actual calculation of  $f$  is in fact not as simple as above, as described in the following.

## 2. Correction for multiple connections

If an institution has more than one network connection, the payment model is adjusted accordingly, the reason for this being that there is not always a relation between economical size and the need for more connections, which are among the most significant cost drivers for the network.

By multiple connections is meant

- Network connections to geographically separate locations of the institution
- Multiple connections to the same location (usually ensuring redundancy) established exclusively to serve the particular location
- The possibility of delivering multiple optical connections to a location (usually by placing an OADM at the location)

For the main cost elements that make up the important parts of the cost of establishing multiple connections to an institution, a set of yearly nominal prices are used:

Cost element	Name	Nominal price in 2018
Possibility of multiple optical connections	OADM price ( $P_{OADM}$ )	100,000 DKK
Set of 4 transponders 10G	T10G price ( $P_{T10G}$ )	25,000 DKK
Set of 2 transponders 100G	T100G price ( $P_{T100G}$ )	100,000 DKK
Connection to a geographically separate location	Line price ( $P_{Line}$ )	50.000 DKK

As most of the 10G connections are made with a redundant protection path, 4 transponders are counted per connection. If the connection is realized without this protection path, half the T10G price is counted for that particular connection. The Line price is the same irrespective of how the connection is realized (dark fibre, capacity or wireless) and it does not depend on the actual prices for establishing and operating the connection (within certain limits, see below).

The reason for using these nominal prices rather than actual prices is that this would incur a lot of administration and with this model it is generally easier to predict the marginal cost to an institution for a new connection.

The part of an institution's payment that comes from these elements is called the "physical" part  $\Phi_i$ . If  $N_{element,i}$  denotes the number of elements used by an institution, the nominal price of the part of the institutions payment, related to the physical parts of the connections is

$$\Phi_i = P_{OADM} \cdot N_{OADM,i} + P_{T10G} \cdot N_{T10G,i} + P_{T100G} \cdot N_{T100G,i} + P_{Line} \cdot N_{Line,i}$$

This part of an institution's payment is not just added to the price calculated in section 1 above, since that price also included the first connection to the institution. Therefore, the part of the payment that covers traffic handling and all other costs not directly related to the physical connections to the institution is

somewhat lower. The reduction factor used to calculate this is the so-called “traffic factor”,  $T$ , which was 89.5% in 2018.

The resulting payment of the institution is then  $p_i = \Phi_i + T \cdot f \cdot e_i$

The calculation of  $T$  and  $f$  is sought to be made such that the payments of institutions without multiple connections is not affected by other institutions getting multiple connections. If  $N_{mult}$  denotes the number of institutions with multiple connections and  $P_{ac}$  denote the average price of a simple connection, the actual calculation of  $f$  is done like this:

$$f = \frac{E - \sum_{mult} \Phi_i + N_{mult} \cdot P_{ac}}{\sum_{all} e_i}$$

And then  $T$  is calculated such that we get all the costs covered:

$$E = \sum_{all} p_i - \sum_{mult} p_i + \sum_{mult} p_i = f \cdot \left( \sum_{all} e_i - \sum_{mult} e_i \right) + \sum_{mult} \Phi_i + T \cdot f \cdot \sum_{mult} e_i$$

Rendering

$$T = 1 + \frac{E - \sum_{mult} \Phi_i - f \cdot \sum_{all} e_i}{f \cdot \sum_{mult} e_i}$$

An account of all connections and the calculation of these parameters is done in the second half of the calendar year when all annual reports of the institutions from the previous year are available, and the results are made publicly available at the DeiC webpage [www.deic.dk](http://www.deic.dk). Shortly thereafter, invoices are sent to the institutions.

### 3. Other conditions

The board of directors of DeiC may, in exceptional cases, decide to adjust the payment for an institution if it is significantly out of proportion to the actual expenses of connecting an institution. This may work both ways. Similar corrections can also apply to single connections of an institution with multiple connections.

Supplementary to the payments stipulated in this payment model, the institution will always have to pay separately for services that are not part of this cost sharing scheme (so-called un-bundled services), such as server certificates and Kaltura media hosting.

Institutions without network connection from Forskningsnettet that consumes other services from DeiC will not pay according to the payment model in this document, but according to the payment model for the relevant service(s), the details of which can be found on the DeiC website [www.deic.dk](http://www.deic.dk). This, for instance, applies to the services WAYF and eduroam.

As described in the Terms for connection to Forskningsnettet, there is a possibility to connect entities such as service providers and data exchange partners of the connected user institutions. Such entities are to pay the actual, marginal costs of establishing and operating the connection, however minimum DKK 15,000 per year.

Finally, the connected institutions need to recognize that the payment model may be adjusted by decision of the board of directors of DeiC. DeiC will notify users of changes to the payment model in the year before these changes are applied. Changes in institutions' payments due to changes of the payment model can be expected to be capped to an increase of 5% per year and a decrease of 10% per year.

Even in years with no changes to the payment model and no changes to the price elements for multiple connections, the actual payments may still change somewhat due to changes in the turnovers of the institutions and changes to the number of cost elements consumed by the institutions with multiple connections. This is a consequence of the cost sharing scheme of Forskningsnettet.

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This whole model may seem a bit over-complicated, but compared to the accounting scheme used previously to keep track of traffic volumes and other elements, the payments in this model only depends on data which is relatively easy to obtain and verify: turnovers and the number of lines, transponders etc in use by the institution itself. DeiC publishes all these figures every year (usually in October/November) at the time when the yearly invoices are sent out.