

OP PIK 4.1 – HIGH-SPEED INTERNET

**Manual for applicants and recipients of the grant within the
Operating Program of Enterprising and Innovation for
Competitiveness (OP PIK)**



Table of Contents:

Part I.

1. **Rules for applicants, qualified costs, and summary of criteria, which the grant recipient is bound to meet**
 - 1.1. Territory coverage, blank spaces, private investment protection, general requirements for the documentation to the Grant Application
 - 1.2. Grant subject determination – passive infrastructure of NGA networks, priority, and qualification of cost
 - 1.3. Points of connection of NGA networks to other networks of electronic communication, definitions and related duties
 - 1.3.1. Network structure.
 - 1.4. Coordination of NGA public network development with the development of other networks, and relations between the supported and unsupported development section
 - 1.5. Accessing the passive building infrastructure of third parties
 - 1.6. Development and building parameters of passive infrastructure, which is part of NGA development
 - 1.7. Building and technical parameters of connecting (backhaul) network
 - 1.8. Building and technical parameters of distribution network
 - 1.9. Building and technical parameters of subscribers' network
 - 1.9.1. FTTx networks
 - 1.9.2. Cable TV networks (CATV)
 - 1.9.3. xDSL networks
 - 1.9.4. Wireless access networks
 - 1.10. Settlement of easements with entities affected by NGA network development
 - 1.11. Geodetic alignment of the network and its registration in the Register of Map Documents

Part II.

2. **Economical section – requirements for economical parameters of the grant applicant and recipient**
 - 2.1. Summary of key parameters of the business plan being the subject-matter of the grant application.
 - 2.2. Simplified Cash Flow model of the entrepreneurial plan being the subject-matter of the grant application
 - 2.3. Profit and loss report of the applicant for previous 2 years

Part III.

3. **Project study requirements**
 - 3.1. Mandatory information
 - 3.2. Applied technology

- 3.3 Amount of residential building address points
- 3.4 Solution method of connecting and distribution network

Part IV.

- 4. **Required parameters of NGA networks, assessment methods, measuring and evaluation**
 - 4.1. **Definition of NGA networks, required connection speed, parameters, verification, quality of services,**
 - 4.1.1. Qualitative parameters of NGA networks.
 - 4.1.2. Parameters of operating reliability of NGA network (SLA for the end subscriber of residential type)
 - 4.2. **CTO methods for measuring and evaluation of data parameters of fixed networks of electronic communications**
 - 4.3. Conclusion and summary

Part V.

- 5. **Wholesale offer – Instructions for creating and publishing a wholesale offer of accessing NGA networks developed with the use of the grant Program “High-speed Internet”.**
 - 5.1 Introduction, general principles
 - 5.2. Assessment method and ensuring compliance of offers with this document, and settlement of disputes
 - 5.2.1. Assessment of wholesale offer compliance with Instructions
 - 5.2.2. Resolution of disputes

Part VI.

- 6. **Related documents, references to sources, definitions and abbreviations used.**
 - 6.1. **Related documents:**
 - 6.2. **References to sources:**
 - 6.3. **Definitions and abbreviations used:**

List of pictures:

Picture 1 – NGN network structure

13

List of tables:

Tab. 5 – Set of rules for stable operation under MEF 23.1 - PT 1 – CoS Low	46
Tab. 6 – Set of rules for stable operation under MEF 23.1 - PT 1 – CoS Medium	46
Tab. 7 – Requirements for the relationship between subscribers and NGA transmission capacity	48

Important note: Parts of the text serving as suggestions or comments are written in italics. This differentiation however does not apply in case of equations and letters in mathematic relations.

Part I.

1. Rules for applicants, qualified cost, and summary of criteria, which the grant recipient is bound to meet

Under the terms of EC Directives 2013/C25/01 and based on the National Plan for the Development of Next Generation Networks (hereinafter NPRSNG) approved by Government of the CR, the grant recipient is in designated localities (see the map of so-called blank address points of residential buildings and "blank ZSJ", based on collected data on the Czech Republic territory coverage as at 31.12.2015, and the planned coverage by 31.12.2018, based on which territorial localization of the intervention locality was designated, that was approved to the grant applicant as the locality of his project) bound to realize NGA network, which is characterised in the manner that it must be ready to provide end subscribers with high-speed Internet connection through NGA network according to the conditions stated below.

To ensure a meaningful development of NGA networks within the CR, the recipient of the grant is bound to meet many other criteria set in NPRSNG and further specified in this manual and other annexes to the invitation for grant application submission (hereinafter the Invitation). Criteria define additional general building, operating, and technical parameters of NGA networks, and also verification methods of how these requirements were met, to be able to include the development cost of this network among qualified cost and settle the cost, or to be able to settle its proportional part up to the amount under the terms and conditions of the Decision on the provision of this grant.

1.1. Territory coverage, blank spaces, private investment protection, general requirements for the documentation of the Grant Application:

Designated locality (Intervention area) is understood a set of blank spaces (ZSJ) that were identified based on CTO data collection as at 31.12.2015. The set of Intervention areas determines the scope of the territory to be covered with new (modernized) NGA networks developed with a state assistance.

- determination of the intervention area must enable long-term (7 years) sustainability of network operation
- the size of the intervention area must meet OP PIK criteria, i.e. the state assistance degree for single Intervention area may not exceed the amount of CZK 200 mil.
- selection of the intervention area size should lead to the coverage of municipal territories with several thousands of address points of residential buildings.

The applicant for a grant for the new NGA network development (or upgrade of the existing broadband network to NGA network) must comply with the conditions prescribed by MPO (see the Invitation document and its annexes) and meet other legal requirements for operations related to development, operations, and maintenance of electronic communication networks, and operation of the public electronic communication network. Approval of the grant for NGA network development is subject to applicant's ability to ensure the development of a new network, or redevelopment (upgrade) of his existing public network of electronic communications, **so that a compact network is created, capable to provide end users with access to high-speed Internet services**, either through their own network or using combination of own network and sections of a contractually leased network, or networks of an entrepreneurial consortium.

Newly build NGA network and modernized existing network (to the condition that meets NGA network requirements) using the grant must after its completion provide subscribers with reliable internet access under terms and conditions set in NPRSNG and specified further in this document, i.e. with effective speed min. 30Mbit/s (*in forward direction*), assuming that such network must enable the users to access the Internet with the effective speed exceeding 100Mbit/s (*in forward direction*), by simple replacement of active technology, not later than by the end of 2020.

NPRSNG states that the development or upgrade of NGA network with assistance must not cause destruction of private investments into development of NGA networks that were registered in CTO data collection, used for determination of intervention areas. Grant recipient is therefore bound to avoid in the grant-aided development of NGA network (in compliance with art. 66 of EC Directives mentioned above) such address points of residential buildings where another legal entity – operator of the public network of electronic communications has already been operating (the operator before the date the Decision on grant approval was signed) other public network of electronic communications, providing subscriber's with high-speed Internet access corresponding with the general definition of NGA stated in NPRSNG and specified further in Chapter 4.1 hereof. Networks being subject of private investments protection are in particular FTTx, HFC, and CATV networks, however also the networks that meet NGA network requirements by their parameters, but without for example sufficient capacity (mainly optical) connectivity. These networks may use for example the LAN network infrastructure, advanced wireless infrastructures, etc. as a subscriber premises network, even in case when, until the time of connecting (backhaul) or distribution optical network development into the object served by LAN network, for instance a microwave connection of point-to-point (P-P) type is used for connectivity to the parent network, with lower capacity than required by NGA network (for existing number of disposable connections). These networks were either declared directly to the operator, in CTO data collection on Czech Republic coverage with high-speed Internet network access, or as networks in the area of further development of NGA networks. The reason for protection of such (incomplete yet) network is that the network may be at any time switched to optical distribution network, or use a high-capacity microwave P-P connection operated based on individual permit (eventually also in the free bandwidth of 80GHz), where the operator of such network may guarantee the compliance with NGA network parameters and provide any network subscriber with effective access speed of 100Mbit/s and more, if active elements are replaced.

It is necessary to consider similarly any other local network, which is a public network of electronic communications and which is in its distribution network and also in the section of users' lines capable to meet technological requirements for NGA network with access speed higher than 100Mbit/s to each user, but certain section of high-capacity optical connection is missing, so that the integral NGA network cannot be realized. On the contrary, connection using a wireless network operated in free – shared bandwidths ("WIFI" technology), using radio transmissions in P-MP configuration is not automatically considered a network enjoying protection of the grant provider (with the exception stated in art. 1.9.4 below), since the operator of such network is in most cases not capable to guarantee compliance with the conditions required for NGA network, or the guarantee of connection reliability based on the use of free frequency bandwidths is in the future out of the question.

Covered address points (where the public network of electronic communications meeting the condition of high-speed Internet connection has already been operated) subject to investment protection in specific ZSJ, which will fall within the intervention area of the invitation, were identified and their list made available to the public within the annex to documents for public consulting on data collection for Czech Republic coverage by public

broad-band networks for internet connection and within public consulting on the intervention areas proposed.

Potential upgrade of the existing NGA network, which is subject to private investment protection, and which is located in the area indicated during TSJ mapping for 2015 as a blank space, and which will not obtain state assistance for its upgrade, is not bound by rules stated in this document. The scope and quality of such upgrade will be fully at the discretion of its owner. MPO however suggests its investor and operator to comply with required qualitative parameters for NGA network within his own commercial interests.

Should the grant recipient fail to respect the duty to protect existing NGA networks within the blank space and decide to compete with an already developed existing network even in address points connected by existing network, he may do so at his own expense only. The grant recipient may not include the cost of connections developed within the newly built competitive network to address points connected by already developed existing network in the final accounts of the project being subjected to the grant (so-called qualified cost). Such connections therefore cannot be included in the number of reported newly developed NGA connections within the project being subjected to the grant. In case of ambiguities, the development cost of the connecting and distribution network are divided proportionally to the number of covered and uncovered address points of residential buildings at the time the Decision of grant approval is signed. Should the grant recipient include the cost of already covered address points of residential buildings in the list of qualified cost, MPO will decide that this is not the qualified cost (or aliquot part of this cost – e.g. for the use of grant-aided connecting network) and may even consider such inclusion of the cost a grant fraud incompatible with conditions of the grant – with all associated consequences.

Conditions of the NGA networks development (upgrade) assistance project determine that the qualified cost might be only the cost, which the work was actually executed for, and the related date of taxable supplies was later than the date, which the grant applicant sent his application for the grant on to the administrator of the grant funds (MPO), which cannot be earlier than the day, which the MPO released the Invitation to submit grant application on, however within such project only, which is reported in the invitation for registration as an intervention area. Project work including eventual building permit, zoning decision, or zoning approval effective before applicants registration for grant approval are not considered initiation of project execution and thus cannot be subjected to the grant. Project execution initiation is considered initiation of engineering, construction, and assembly works, and the purchase of technology after the applicant sent his grant application to MPO. Therefore, the technology purchased before the submission date of the grant application to the tender for the specific intervention area, and also other related activities (including expenses for the project study and project preparation for zoning decision), the taxable supplies date which took place before the applicant's registration day to the project, cannot be considered as qualified cost.

In the network development, the grant applicant must (if selected in the tender as a grant recipient) meet all legal conditions that are necessary for the development of electronic communication network. In addition, he is bound to meet the conditions set by NPRSNG and the Invitation, including all annexes.

The grant applicant shall attach to his tender application for predetermined intervention area (consisting of a set of blank ZSJ determined in the mapping of the area) the following:

- **project study** of NGA network development in the intervention area in question, including specification of the technological solution, proposed cable routes with indication of prospective use of passive infrastructure of other subjects, and description of the technical

solution enabling to meet the condition of access speed and other parameters prescribed for NGA networks;

- **list of address points** updated with the number of address points of residential buildings and estimated number of flats (according to the database describing respective intervention area), which the applicant intends to connect in the area within NGA network development, and resulting percentage of NGA network coverage compared to all address points of residential buildings in the intervention area;

- **estimated quantification of the cost** of NGA network development and related passive infrastructure in such structure to be to assess the grant application in the tender (inter alia updated with the so-called “bill of quantities”, and the summary of elements and prices of passive infrastructure). To verify the business plan, it is necessary to submit also the estimated volume of technological cost of the project for verification of the business plan – see below;

- **brief business plan** (prepared under the attached sample stated in the document “selection criteria”), demonstrating sustainability of NGA network operation for a period of min. 7 years from the project completion date. In case the grant applicant is not at the same time a provider of public services of electronic communications, such a business plan must then also include data on estimated network rental income from the service provider, and estimated cost of network operation and maintenance, which is important information for the grant provider on whether the grant recipient is capable to ensure operating profitability and thus also long-term sustainability of his project;

- **description of general principles of the wholesale offer**, i.e. how the applicant is ready to ensure to share his network built or upgraded using the grant funds with other parties interested in providing services of electronic communications under “**Instructions for creating and release of the wholesale offer to access NGA networks**” (part V. hereof). At the same time, the applicant must undertake in writing to comply with them, and release his complete wholesale offer (and inform the grant administrator) six months before starting the operation of the grant-aided network;

- **copies of contract, or contracts on future contracts** on the use of the infrastructure and property of third parties, should the applicant cover all intervention areas or their part using the network or networks not held by him and thus not subjected to the grant. The requirement for presentation of these contracts does not apply to easements, land appropriation, and similar anticipated qualified cost;

- **expert estimate** of the amount of average settlement of easements for installation of networks outside residential buildings, especially for underground and overhead lines of the cable network. These estimated costs will be used by applicant in the calculation of the estimated project cost.

1.2. Determination of the subject-matter of the grant – passive infrastructure of NGA network, priorities, qualification of costs.

Passive infrastructure is such a part of the infrastructure of the electronic communication network that is not active. Active part of the electronic communication network infrastructure is such part of the infrastructure that needs a power supply for its operation. For the purpose of this project, the passive infrastructure includes also such parts of the building infrastructures that serve for laying and installation of electronic communication networks.

Passive infrastructure includes in particular:

- Cable routes designed for cable lines that include optical and metallic communication cables (including these cables) and related components,
- Plastic protectors for installation of optical cables,
- Warning cover foils and plastic protective panels of underground networks,
- Cable ducts and cable cellars, connections, trenches, alignment components
- Distribution boxes of electronic communication networks including power supply connections for active technologies (it does not apply to passive chemical power supplies), if it is necessary to install active technologies in this distribution boxes for NGA network operation,
- Support elements for the assembly of overhead optical cables,
- Columns, poles, and antenna carriers for installation of network components (if necessary for operation of the designed NGA network),
- Passive elements related to installation of the optical, metallic, and coaxial network, such as ODF, connector fields, connectors, hubs, and cable organizers,
- Other installation material and other investment cost of passive infrastructure development, including operational design, geodetic alignment, and the cost of entering the network information in the register of passive infrastructure (RPI,) after this register is set up.

The qualified cost however does not include the cost of distribution boxes (racks), which do not include terminals of physical network layer and associated respective passive elements (ODF, connector field, optical distribution panels, optical filters, notched tapes, etc.). The qualified cost may not include the cost of the technology (inter alia also investments to boxes, stands, distribution panels, and connecting cables) required for network operation by competitive network operators who use for their business activities the complete network of the grant recipient or its part, developed or upgraded with financial assistance of the state. The qualified cost also does not include the cost of active technology providing required temperature and humidity environment for active elements of the grant-aided network (heating, cooling, A/C).

The subject matter of the grant is thus development of the passive part of the access NGA network including related necessary project, digging, assembly and installation work and also settlement of easements (right of access), and settlement of necessary appropriations of public areas during network development, or settlement of damages in agricultural plants in the amount proved.

In localities where a building permit was issued for residential buildings, or a zoning decision for the development of utility line networks, which will be used for future coverage of residential buildings in the intervention area, the grant recipient will be able to include the cost of the high-speed electronic communication network design and the cost of development of the passive building infrastructure for such network (e.g. installation of cable protectors in pavements developed in the municipality that belongs to the intervention area) in the qualified cost.

Part of the access NGA network is its connecting (backhaul), distribution, and users' network.

->**Connecting network (backhaul)** may be defined as a network connecting the backbone network and the main node of the connecting network, so-called CO ("central office", "central station", "distribution centre", "main station", etc.), where the distribution network

serving the intervention area connects. Within the program of grant-aided NGA network development, the connecting (backhaul) network must be of optical type only.

->**Distribution network** connects individual municipality districts, several municipalities in the intervention area, or adjacent localities, and provides connectivity to individual distribution points (DP) and assembling points (AP), where subscribers' networks are connected. Distribution and access points may be at the same location. Distribution network section is usually optical, or (in order to connect such number of households that the operator may guarantee safely sufficient transmission capacity for all subscribers interested in high-speed connection and other required parameters) also wireless, or metallic (mainly coaxial).

->**Users' network** is part of the NGA network between the access point (AP) and the end user (subscriber). Subscribers' segment of the network may consist of two parts: from the section of the access NGA network owner and the section of internal installation in the building, which may be owned by other subject (network operator, building owner, or even end user). *Users' network intermediates direct connection of the end user to the network providing Internet connection service, or using active devices located in the subscriber's flat (so-called Customer Premise Equipment – CPE).*

Users' network may use any technology, however it must guarantee that NGA network requirements set in Part V. hereof are met.

The subject matter of the grant is the development of (upgrade) of the whole access NGA network (network infrastructure) – i.e. the NGN network section from the meeting point with the backbone optical network of the municipality, or set of municipalities (ZSJ) within the designated intervention area where the applicant for a grant for NGA networks development will execute his operations, and also development (upgrade) of users' networks from the so-called access point on the distribution network to the end user. Termination of the subscribers' network (network end point) is possible in the users's flat or house, where a building network connects to this network (so-called transfer point), which is owned by building residents. If the owner of the residential building does not agree with the connection of NGA network, or the grant recipient will not be able to obtain owner's approval, the users' network may be terminated in a suitable point at the building footing, or at the border of the private land, which the building is located on, so that it is possible at this point to make a connection to the user's flat (flats) in the future in compliance with the provision of the Act on facilitation of electronic communication network development (transposition of the Directive EC 61/2014).

In the designated area, the grant applicant is bound to guarantee min. 40% (in case of intervention area, which an NGA network is operated in through 2 and more different infrastructures of the subscribers' network), or min. 50% (in case that 1 infrastructure type of the subscribers' network is used only to cover the area) connection of address points of residential buildings (detail determination is stated within specification of respective intervention area), and such connection must meet conditions of the transmission rate and other parameters, as stated in NPRSNG and this document, or in other annexes to respective invitation round. Transmission capacity of passive network elements at the level of connecting and distribution network must be capable (upon replacement of active network elements only) to guarantee the transmission capacity for anticipated min. 75% target penetration of address point connections in residential buildings, which were at the beginning of the project not covered by high-speed connection network (NGA). In case of upgrade of the existing broad-band network, which does not meet NGA attributes, it is possible to get a state support for its modernization to NGA network condition (including its expansion), assuming also that required conditions of the access speed and other parameters

will be met, as stated in NPRSNG and this document, or other annexes to respective invitation round.

For this purpose, the grant applicant may associate his business with other legal entity and form a business consortium (association, registered corporation, coop, or create another subsidiary legal entity with several owners) assuming that other entities being members of the consortium must also meet prescribed general conditions (see the Invitation) that do not prevent them to be a grant recipient, or to be in the relation of contractual partners with the grant recipient, ensuring to the applicant in compliance with conditions stated in NPRSNG and respective contractual document the operation of such part of the network, which is part of the integral NGA network, as stated above. In case the grant applicant intends to use the existing network, the owner of which is another entity (e.g. already built NGA network within the municipality, or on the contrary connecting (backhaul) network of another entity), he must document the integrity condition of NGA network development at least by Contract on future contract with the owner of the network that will be used for such purpose.

-> Summary of qualified expenses of the program Development and Upgrade of Networks for High-speed Internet Access.

General:

a) investment cost of the development of passive network infrastructure of high-speed Internet access

b) investment cost of contraction and engineering works related to the development of network infrastructure of high-speed Internet connection, or upgrade of the existing broadband infrastructure to the condition of high-speed infrastructure of access networks of new generation (“NGA networks”).

Within the abovementioned, the qualified cost usually^{*)} include:

- Development and upgrade of cable routes designed for cable lines, including optical and metallic communication cables (including these cables), and related components and their installation,
- Plastic protectors for installation of optical cables,
- Warning cover foils and plastic protective panels of underground networks,
- Cable ducts and cable cellars, connections, trenches, alignment elements
- Distribution boxes of electronic communication networks including power supply connections for active technologies (it does not apply to passive chemical power supplies), if it is necessary to install active technologies in this distribution boxes for NGA network operation,
- Support elements for the assembly of overhead optical cables,
- Columns, poles, and antenna carriers for installation of network components (if necessary for operation of the designed NGA network),
- Passive elements related to installation of the optical, metallic, and coaxial network, such as ODF, connector fields, connectors, hubs, and cable organizers,
- Other installation materiel and other investment cost of passive infrastructure development
- Operational design, geodetic alignment, and the cost of entering the network information in the register of passive infrastructure (RPI,) after this register is set up.
- Settlement for easements (right of way) that are entered into not to be in conflict with the provision of Section 18 of the Act no. 151/1997 Coll., on property appraisal, assuming that the settlement cost of easement establishment is in the amount usual at that time and in that location, and payments for appropriation of public areas at the time of network development, if it is necessary for NGA network development.
- Compensation for damages in agricultural crops in the amount proven, if it is necessary for NGA network development.
- Development of new supports (poles) for overhead cable lines of the NGA network (if such solution is approved by respective building authority)
- Upgrade of the existing overhead cable lines
- Network connection to buildings (blank address points of residential buildings)
- Cable network installation inside residential buildings including assembly of required distribution panels
- Termination of the cable network in the customer’s flat including installation of a subscriber’s outlet
- Power supply connection to the distribution panel inside the building, if the power supply is necessary for NGA network operation.

*Note *) if these expenses are not in conflict with other regulations stated in the invitation.*

1.3. Connection points of NGA network to other networks of electronic communications and accessing the network, definitions and related obligations.

In order to ensure integrity of the NGA network and thus access of end users to all services, which the network is able to provide, it is necessary to connect the (access) NGA network to the parent (backbone) optical network. This connection point of the connecting (backhaul) NGA network and the backbone (core) network is indicated in the network topology as POP¹ (Point of presence), which is (for the purpose hereof) the connection point of two networks of different levels and (usually) different owners (operators). See also the example² of a backbone network map. In addition to connection between optical networks ensuring connectivity of the end user on the NGA network to the point, which the network operator access the public Internet network in (so-called Peering centre, e.g. Neutral Internet Exchange – NIX), it is at this point required on the part of the grant provider, that the grant recipient guarantees IP connectivity meeting speed and qualitative parameters required for NGA networks from this point up to the end user. It is at the same time required, that the bit-stream from this point (POP) up to end users can be shared on the NGA network by other providers of converged IP services who would be interested in to share the NGA network of the grant recipient for regulated wholesale price (the obligation to provide the network for operation of services for regulated price under the wholesale offer applies for the entire NGA network section, the passive infrastructure of which was developed with state assistance – see Part V hereof). The section from the connection of the backbone and access network (POP) to the connection of the backhaul and distribution network in NNI³ point CO (Central office, HS, DC), must enable other authorized operator of the electronic communication network to share also the physical level of the backhaul NGA network in the lease form of non-illuminated optical fibres. In following sections of the NGA network, i.e. distribution and subscribers' network, the grant recipient is bound to either enable to access his network on the physical layer or virtually (VULA) in NNI, or at the "central office" point, main station, etc., and at the network terminal point, if the access to physical layer is technically impossible. Distribution network is a network section between NNI and access points, where subscribers' stations are connected to the distribution network. Access to the network developed or upgraded using a state grant (physical access to the network, virtual access – VULA, and bit-stream sharing) for the price not exceeding the grant recipient's cost of the purchase and operation of the network (according to the cost model expressed in the Wholesale Offer Methodology, which is binding for NGA networks developed with state assistance) is one of the basic duties of the grant recipient. The duty of wholesale access to the network is not restricted by investment sustainability period. After termination of the period of mandatory sustainability, the grant recipient will not be obliged anymore to follow the price regulation related to network accessing, or its passive (building) infrastructure under the cost model – see Part V. hereof.

The grant recipient may however also make an arrangement with his contractual partner on significantly broader conditions of network accessibility, should this express the will of both parties.

One of the primary methods of the connecting optical network (backhaul) is the lease of non-illuminated fibres for the regulated price of the wholesale offer. The option to lease the passive building infrastructure (cable ducts, cable protectors, and micro-tubes) is supported by grant administrator as an alternative to the lease of non-illuminated fibres.

If another network type is used, the duty of the wholesale offer applies similarly, and the details are described in the mentioned Wholesale Offer Instructions prepared by a working team under CTO management (see also Part 5 hereof).

¹POP - <http://www.thenetworkencyclopedia.com/entry/point-of-presence-pop/>

²Backbone network – example: <http://business.upc.cz/pdf/13425-mapa-A4-sirka-finalni.pdf>

³NNI - <https://www.techopedia.com/definition/8560/network-to-network-interface-nni>

The NGA network operator is obliged to create such technical conditions at connection points with other networks (POP and CO), so that connections of other networks is technically possible under transparent and non-discriminatory conditions, and concurrently, that these points allow connection of temporary CTO measuring technologies, if requested, enabling to find out or monitor the speed and quality of data transmission on the NGA network in order to check whether the conditions stated in the document NPRSNG and art. 4.1 below are met.

Explanation of the terminology: Building and technical parameters of NGA network, types of the infrastructure, network topology, and transmission topology used.

NGA networks use various types of passive infrastructure, which is the subject matter of the grant for the development of networks enabling high-speed Internet connection. If we except the building part of the infrastructure (cable ducts, cable cellars, columns, poles) and follow the telecommunication infrastructure only, these are in particular transmission lines of the metallic network type (especially coaxial and symmetric lines, fibre optics, and radio transmissions, that form the so-called physical layer of the transmission infrastructure (passive parts of the electronic communication networks). This network infrastructure may have various forms and methods of regional coverage (topological structure), and in particular in case of fibre optics it is distinguished where the terminal point of the optical network is to connect other infrastructure types. These different network infrastructure types are used by various transmission technologies that are a purposeful arrangement of passive and active elements enabling data transmissions within the transmission infrastructure or in the open space. It is therefore always necessary to distinguish the infrastructure (e.g. metallic or optical lines), its topology (e.g. FTTH, FTTB), and the transmission technology used (e.g. 1000Base-T, CATV, etc.) that use the passive network. With respect to the high number of different transmission technologies, it is obvious that some of them can employ certain characteristics better than other infrastructures and topologies. MPO as a grant administrator however follows strictly the technological neutrality, and if there are some restrictions in this document, they relate to physical limitations of certain technologies only, in particular in the subscriber segment of the NGA network. For the purpose hereof, following chapters 1.7 to 1.9 specify the meaning of individual network infrastructure types and conditions of their use, including links to assessment criteria C8 and C5 of the Selection Criteria document

1.3.1. Network structure.

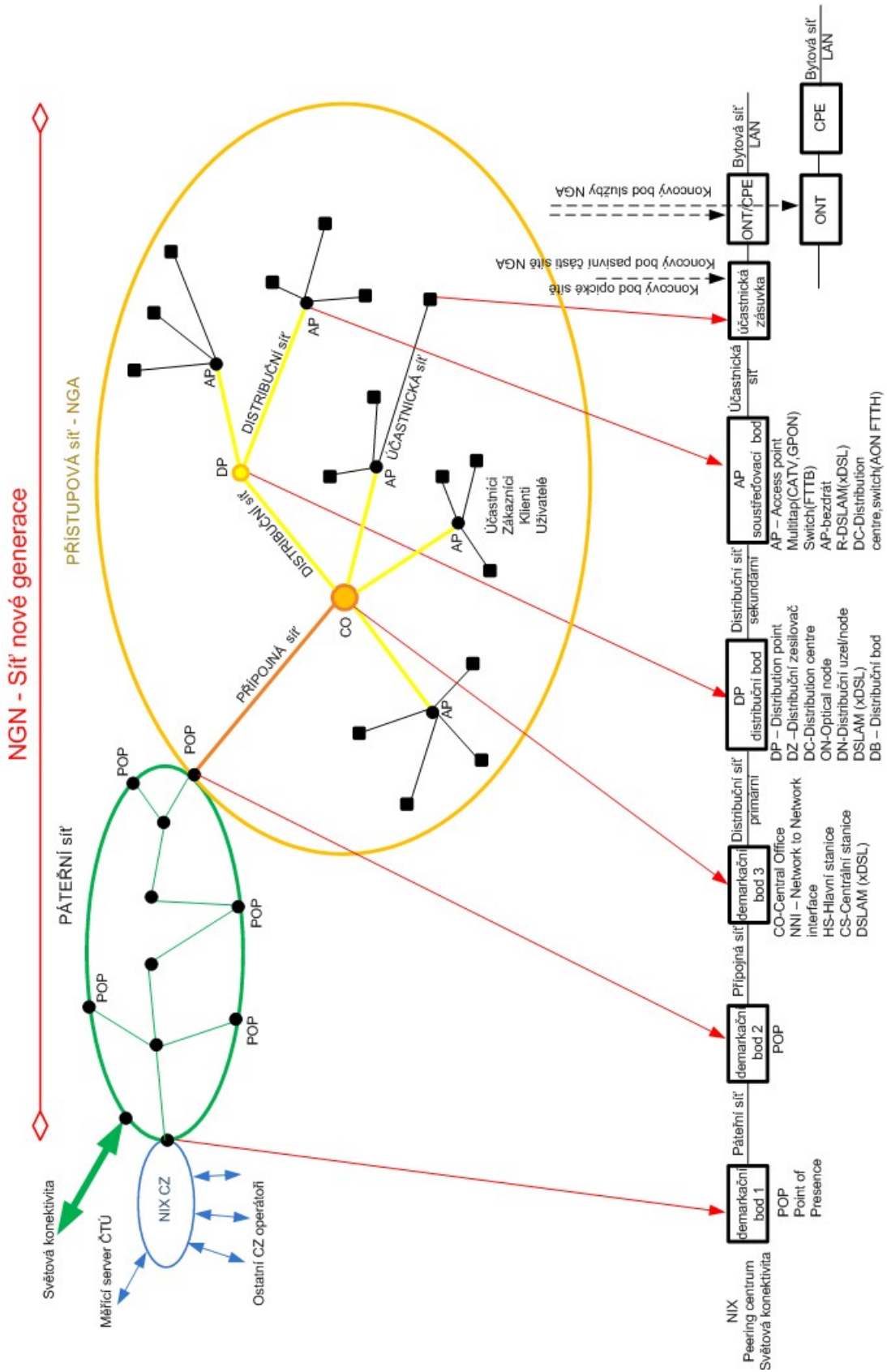


Fig. 1 – NGN network structure

1.4. Coordination of NGA public network development with the development of other networks and relations between the grant-aided and unsupported development parts

There is a natural effort in the interest of the Czech Republic to use efficiently the funds spent by state to support the development of NGA networks. For this reason, MPO as provider of grants requires from the grant recipient:

-> to coordinate the development of NGA networks, in particular connecting (backhaul) networks, if possible, (suggested procedure), with other grant recipients or applicants for assistance with the development in neighbouring intervention areas, and also with the state administration authority appointed within MV that is the investor and operator of non-public telecommunication networks. Within coordination and optimization of the cost of state administration, MPO is authorized to submit the project study of the applicant, who was given this Decision on grant approval for NGA network development, to this authority. If the state authorities are interested in cooperation with the grant applicant and take the opportunity of NGA network development for installation of their own non-public networks of electronic communications, the applicant is, in compliance with the act which is a transposition of the EC Directive 61/2014 to the Czech law, bound to cooperate with this contractual partner in realization of the specific requirement based on the equality principle and mutual economical expediency (in particular settlement of a share of work expenses).

-> in case that other investor of the telecommunication network development approaches the grant applicant, under the conditions of EC Directive on facilitation of NGA network development (EC 61/2014) that will be implemented as a new statutory provision, with a request for installation of additional cables in the trench for underground lines (or with any other request for coordination of construction works), the grant applicant is obliged to satisfy such request within the conditions of the act stated above (settlement of a share of work expenses).

-> should this method increase a number of cable elements in the trench, the grant recipient is obliged to enter into a contract on the settlement of expenses of the underground cable line development with the entity participating in exploitation of earthworks, so that distribution of payments to individual entities (including eventual joint investment of MV and other state administration authorities) is not discriminatory for any participating investor. With respect to distribution of the cost of electronic communication networks of different investors, the settlement of the cost will be based on the number of cable elements (protectors, or cables laid directly to the ground) in the trench, or the settlement will also include prospective authorized additional cost in the amount proven. In case of concurrence with other utility network, the cost distribution must respect also demonstrable additional cost of trench expansion, independent drill-offs under roads, etc., to be able to preserve requirements for spatial separation of different networks according to respective technical standard.

-> in case that the grant recipient is, in addition to the network development in residential buildings identified in data collection as blank address points of residential buildings in that intervention area, interested to use of the NGA network route also for other business activities that do not relate directly with NGA network development in that intervention area, he must ensure proportional distribution of the cost, as if it is a third party's investment. This does not apply, if the grant recipient uses part of the grant-aided NGA network for connection of business entities in respective intervention area that

demonstrably lacked high-speed Internet connection before initiation of the grant-aided network development.

-> the coordination objective is to achieve transparent cost reduction in the NGA network development. Therefore MPO is in the interest of such cost reduction authorized to even enter into such coordination negotiations (e.g. between two entities selected the tender in neighbouring territories as grant recipients for the development of NGA networks) and ask such modification of the network topology that would lead demonstrably to cost reduction (the amount of the state assistance) in the development of these networks (e.g. by concurrence of two lines of the connecting optical NGA network (backhaul)) anywhere, where it is efficient and not in crucial contradiction with the subject matter of NGA network development. In case that the grant recipient documents on MPO's request that eventual coordination with a third party would not result any cost reduction, he is not obliged to bring such coordination into effect.

1.5.Using the passive building infrastructure of third parties

Financial grant for the development of NGA networks provided by MPO is of investment nature; therefore it is not possible to pay the operating cost from these funds.

-> In practice, a situation may however occur when it is less expensive for NGA network development (and faster for its putting into operation) to use the passive (mainly building) infrastructure of another entity (e.g. existing cable protector, cable duct, etc.) than to develop own infrastructure. Therefore, the MPO as a grant provider will be ready to accept such accounting documents as the qualified cost of NGA network development, submission of which in the financial audit would demonstrate unambiguously that this is the cost of investment nature (for details see sec. 47 of Regulation 500/2002 Coll. – determination of items of expenditures that can be included in the purchase price of the long-term tangible assets). For example, it is therefore not possible to include a long-term lease (so-called IRU) in the qualified cost of network development, but it is possible to acknowledge a lump-sum payment for an easement (within restrictions under Act no. 151/1997 Coll., and in compliance with sec 47 g) of Regulation 500/2002), or a purchase contract for part of the infrastructure (e.g. cable protector), including eventual payment for an easement (right of way) related to its specific location, etc. Since the funds spent on the development of NGA networks are needed for the development just as time minimization, MPO will be ready to consult the solutions in public interest that would lead to meeting the target, assuming that such solution will be actually less expensive and more efficient than the new development in that network section and related complete building solution. The purchase contract (or contract on easement establishment) for such work (part of the work) in order to consider it a qualified cost must include the seller's duty that no third party's rights are attached to the subject matter of the work (e.g. collateral for bank mortgage, or also whether the protection period set for sustainability of the grant-aided investment from other state assistance has expired – see below). The seller of the network (in whole or its part) must not be in any proprietary relation with the grant receiver, nor be a member of the same business group.

-> special attention in this connection needs to be therefore paid to the situation when the passive infrastructure developed already, which the grant applicant intends to use (under conditions stated in the previous complex sentence), was built based on another state grant program. These might be for example municipality-owned cable ducts developed within the IROP project, controlled by Ministry for Regional Development (MMR). This part of the

building infrastructure cannot be included in the qualified investment cost. NGA network operator must arrange with the owner of such building infrastructure for the lease (operating cost) of such work for the purpose of assembly and operation of the cable line of NGA network, since no grant may be provided on the part of MPO for the purchase of the work for the market price, if such work was developed using a state investment grant. This applies in particular, if the work is in the protective period as yet, set for sustainability of such (previous) grant-aided investment, since this would represent a duplicate funding of identical qualified costs for the work, the development of which was once stimulated by public financial assistance in the past.

1.6. Development and building parameters of passive infrastructure, which is part of the NGA network

To be able to accept the development cost of the building part of passive infrastructure by MPO as a qualified cost, the extent of this infrastructure must be proportionate to its purpose, which was primarily established for, which with respect to the project of High-speed Internet is the development of the NGA network. MPO will thus not acknowledge the cost as qualified, if it by its amount and/or extent does not correspond with this purpose, or it was planned and/or spent, in addition to meeting the aim of NGA network development, for the purpose other commercial use on the part of the grant recipient, during or even after the investment sustainability period. The developed passive infrastructure must comply with regulations in effect, such as the depth of underground cable line route, route covering, sufficient strength, and static calculation of poles for the wireless communication equipment, demonstrable existence of a document illustrating that hygienic limits of non-ionizing radiation are met (if the NGA network includes radio technologies), and also consent of building owners with network equipment installation in their buildings. A static opinion for suspended cables longer than 60 metres including is also required, including an attestation document for anchoring elements, atmospheric surge protection check-up (where appropriate for network operation safety), and selection of suitable material and site arrangement of distribution boxes, so that their service life is not shorter than of other passive network elements. Last but not least (in particular), completed settled building proceedings, settled easements (right of way), and demonstrable restoration of surfaces (after development of underground networks) are required.

1.7. Building and technical parameters of connecting (backhaul) network

Connecting (backhaul) network is an optical network of electronic communications connecting respective POP on the backbone optical network and the area of interest (of respective municipality within that intervention area), where the development of a new NGA (upgrade and expansion of the existing) network is executed. The connecting network is at this point terminated in the optical distribution panel of the node CO ("Central office"), as stated in Fig. 1. This optical network might be underground, or a combination of an underground and overhead network or it may use also poles of HT and EHT power lines or traction line poles of the railway track as carriers for overhead lines. HT and EHT poles and poles of the traction line must be approved by owners of respective lines, or owners of supports (poles), and respective building authority.

In compliance with Directives 2013/C25/01, the grant recipient's duty is to enable wholesale access to the NGA network developed. In the connecting network section, the grant recipient is bound within the wholesale offer affective for the project sustainability period to enable access to other business entities, which are also operators of public electronic communication networks, to both, physical network layer and the data transmission layer (VULA and bistreaming). In case of access to the physical layer of the cable infrastructure, the

grant administrator has reached the decision that this obligation would be met in particular by lease non-illuminated optical fibres in compliance with the regulations stated below.

-> **Underground line** of the connecting optical (backhaul) network being the subject matter of the grant-aided NGA network development consists of two to three HDPE protectors, usually in diameter 40/3 mm, or in particularly justified cases, from two to three thick-wall protectors of 50/5 mm. One of these protectors is used for blowing the optical cable in, which is also subjected to the grant, the second protector serves as a reserve in case of failures of the optical cable, and cannot be alone subjected to commercial use on the part of the grant recipient, and the third protector may be used for lease of the transmission capacity within regulations of the wholesale offer. The qualified cost includes (within 2-3 protectors stated above) installation of max. one HDPE protector with pre-installed micro-tubes. In case that the grant recipient or another entity wishes to apply other cable protectors to the trench of this optical network (beyond the prospective concurrence of the connecting and distribution, or even subscribers' network of his grant-aided project, or directly the cables), he must prove that it is a development of passive infrastructure within the NGA network project in that intervention area, or a settlement must be made under terms and conditions stated in art 1. 4., and MPO as a grant provider will be advised by grant recipient of such matter. Should MPO not reject the request for additional line under the condition of cost sharing under art. 1. 4. hereof within 60 days, it is assumed that the grant administrator approved this grant recipient's request. Underground line of the optical cable is after certain distances (according to networks topology) supplemented with underground plastic cable cellars that serve for installation of optical cable couplings and cable reserves. Underground cable line is installed in compliance with conditions of the building proceeding in effect, and technologic project, and it is geodetically aligned and provided with respective cable markers enabling subsequent localization of the cable route. If the general conditions are met, these components may also be classified as the qualified cost. Foundation of the underground line of connecting network (or its building infrastructure – cable protector, cable duct, cable cellars, etc.) cannot be included in the qualified cost, if the development of the underground conduit was initiated before signing the contract with MPO on the provision of the grant.

-> **Above-ground line** of the optical cable must use a fully dielectric optical cable with integrated traction elements, designed directly as a suspension cable resistant against UV radiation and using certified anchoring elements. Its assembly must be in compliance with terms and conditions of the contract between the grant recipient and the owner of the overhead line (or the owner as an authorized line operator). Minimum height of the cable line above the terrain is set to 6 m, unless stated otherwise in the contract between the grant recipient and the power line owner. Above-ground cable line must maintain its operating parameters unchanged up to the wind speed of 150km/h, even under ice deposits that may eventually emerge on the cable line.

-> **Optical cables:** connecting (backhaul) optical network must be dimensioned to enable not only the development of interrelated NGA networks in the municipalities involved, but also further development of networks and services of electronic communications for the entire service life of this optical network, at least for the period of 15 years from its development (upgrade). In addition to this task, this state assisted optical network must enable physical access to other competitive providers of electronic communication services in the wholesale offer form, and eventual other legitimate requirements of the state for the operation of non-public optical network. This all applies also in case of configurations of future network circuits, even if this connecting network is built at the time of its development as a P - P network of star configuration only. In doing so, it is necessary to take into consideration that

increased number of fibres in the optical cable represents de facto immaterial cost increase of the optical network development. MPO in the position of a grant provider for NGA network development enters here as a co-investor, is eligible to exercise its decision on what number of optical fibres each part of the optical NGA network is to contain. For this reason, the following is required from the recipient of the grant for the development of the connecting (backhaul) optical network:

-> **optical fibres in the connecting network cable** must meet at least technical requirements of the suggestion ITU-T G.652D or G.657A (underground conduit), or ITU-T G.657A (overhead conduit). In optical couplings of the cable route, the whole profile of fibres must be fused.

-> **minimum number of optical fibres** in the cable of the connecting (backhaul) network is set as follows:

Since the operation of max. 4 competitive operators of electronic communication networks is anticipated in the area of interest (including primary network operator, if integrated vertically with the service provider), 4 fibres will be reserved for the investment sustainability period for eventual use (subject to the payment) of the connecting network on the part of state administration. The number of fibres of the operator will be set in the connecting (backhaul) network, so that for each 5000 residents in the area covered by this network at least 4 optical fibres are considered for data connectivity (also with respect to reserves for possible round off), and 2 reserve fibres, while 1 of these reserve fibres might be used for quasi-analogous transmission means (RfOG - Radio Frequency over Glass) of the CATV network system. Minimum number of fibres in the optical cable at this system level of the network is 48. If the grant applicant comes to the conclusion that the number of fibres should be different, he must justify it.

-> **part of the connecting (backhaul) optical network development** and thus also the qualified cost, if other preconditions required by this document are met, includes also **foundation of optical distribution frames** (ODF – Optical Distribution Frame), where the optical cable is terminated. This ODF must be dimensioned to interconnect all fibres in the cable, with respect to the number of optical connectors that can be fitted in ODF, and the number of cases for optical fusion joints, however the whole cable profile need not to be fitted with connectors. Installation of connectors (including attenuations and reflections on fibres with connectors) on double the number of fibres than needed (according to the previous clause) by grant recipient for the operation of his NGA network. Fitting other fibres with connectors and their measuring for prospective other provider of electronic communication services will be paid under the terms and conditions of the wholesale offer to access the passive infrastructure. In the development of the optical NGA network abreast of the connecting (backhaul) network, optical connectors E2000/APC or SC/APC will be used.

-> the recipient of the grant for the development of this level of the optical network (backhaul) is obliged to operate this network for the whole investment sustainability period (either by himself or through a contractual operator), ensure on-line monitoring of its operability, and provide SLA under Instructions for creating and publishing of the wholesale offer stated in Part V. hereof.

-> Other details of the terms and conditions of the Wholesale Access (SLA, contractual penalties, etc) are set by Instructions for creating and publishing of the wholesale offer for NGA networks (Part V)

-> MPO suggests grant recipients to become familiar with the document of ICT Union "Methodology for the development of shared infrastructure in electronic communications"

1.8. Building and technical parameters of the distribution network

Distribution part of the NGA network serves for interconnection between CO (with connectivity from backhaul network) and access points (AP), which subscribers' networks are connected in (see Picture 1). With respect to the coverage of the intervention area, the distribution network might have one or several levels, be used by various transmission technologies, and connects municipality districts or other municipalities and their parts through distribution points (DP) into an access infrastructure network, the input of which has access points, i.e. components of the electronic communication network, which independent connections of subscribers' network are connected in. NGA distribution optical network may be underground or overhead – e.g. using power distribution lines on poles, if approved by local building authority and owner of the overhead conduit, which this network is to share, and if it complies with regulations in effect approval of respective building authority is required), or also wireless. Since the current Regulation 501/2006 Coll., Section 24, states that electronic communication networks are in the built-up area situated under the ground, it is necessary for the development of the overhead conduit to ask for exception the respective building authority in administrative proceeding (a fee is applied to the application). If the grant applicant or recipient applies for the exception within the program of the grant-aided high-speed NGA network, he must undertake in his request to the building authority to build the overhead electronic communication network in such localities only where an overhead power distribution network exists already, and if the operator of the power network decides to install his network under the ground in compliance with the Regulation stated, the operator of the electronic communication network shall also provide relocation of his overhead network under the ground. Technical and building conditions for installation and operation of the distribution NGA network are essentially identical as for the connecting (backhaul) network; however with respect to the requirement for potential sharing of this network by several operators, this network must meet the following requirements:

-> **In case of optical distribution network**, the number of fibres in the optical cable connected to the distribution point (DP) must be dimensioned with respect to possible access of other interested parties to non-illuminated optical fibres, thus the number of fibres must be at least four times the number of 6 fibres per single operator of the NGA network.

In case that the distribution network is connected to the subscribers' wireless network, there will be min. 4 fibres per single access point (AP).

For suggested max. 6 AP (access points) per single primary branch of the distribution network, 4 fibres are in practice sufficient (with respect to interconnection of fibres in optical couplings, MPO suggests that these fibres are between individual APs in series topologically "inter-looped") per single access point (AP), assuming that max. 3 competitive operators in that locality covered by this network are envisaged (including primary network operator). Other two fibres will be reserved in this network section for state administration needs for the period of investment sustainability, assuming that eventual use of these fibres will be subject to payment in compliance with wholesale offer regulations.

This leads to the requirement that the cable of the distribution network conducted to the distribution point DP includes at least 24 (but max. 72) fibres that will be included in the

qualified cost. If the grant applicant comes to the conclusion that the number of fibres should be different, he must justify it.

This requirement is important in particular in the event that the optical cable is suspended on poles of the overhead power conduit, because it is not expected that the number of such suspended optical cables could be more than one. MPO is authorized to consider whether the designed number of fibres in the optical distribution network is sufficient for that network topology project, and in case it is found excessive with respect to local population, the amount of the qualified cost of this network section might be reduced. Within the distribution optical network, it is suggested to use optical connectors SC/APC, or LC/APC. For span cables (suspended), it is recommended to use fibres suggested by ITU - T G. 657A, and G.652D or G.657A in case of underground cables. Development of new poles for overhead cable conduit of the NGA network counts among the qualified cost only in case, that such solution is approved by local building authority. It is also acceptable to use existing poles of the overhead power distribution conduit, or existing poles of the electronic communication network conduit. Replacement of existing supports (poles) of the overhead conduit of electronic communication network, the service life of which does not cover the whole sustainability period of the "High-speed Internet" project, can be included in the qualified cost.

Note: In some cases, if the backbone optical network passes through the locality, which is the intervention area, the connecting (backhaul) network is with respect to the length minimized and may share the space with other fibres within the optical cable of the distribution network.

-> **In case of distribution coaxial and/or metallic network**, it is not anticipated within the NGA network development that it would require a new network set-up; in addition under regulations of the Wholesale offer stated in Part V., no physical pooling of the metallic (incl. coaxial) distribution network is required. Therefore it is not necessary to define conditions for numbers optical fibres at the distribution network level. Indeed, such network must however meet the conditions, so that the Internet access is guaranteed for the end user in compliance with terms and conditions of NPRSNG and Part IV. hereof.

-> **In case of wireless distribution network**, it will be a potential development of antenna carriers and the connection of the optical and power supply network. MPO is in such case authorized to consider whether the designed costs are adequate for this network section, and if considered excessive, the extent qualified cost of this network section development may be reduced. Such reduction applies for example, if antenna carriers (poles) developed with the assistance of the grant are for the operation sustainability period of the project used commercially (beyond the purpose of NAG network development) also for other reasons than determined in the project. Such reduction of the grant funds will however not be applied, if this type of the building passive infrastructure is used on the part of the NGA network operator for the purpose of the high-speed Internet service provided in a fixed point. Wireless distribution NGA network must use individually assigned frequencies (not bandwidths, where the radio network operation is permitted based on general authorization). This principle might be breached only in case of tapping from the main distribution route assuming that frequency bands of 70/80GHz or higher are used.

-> **Distribution optical network includes** also (part of the qualified cost) the development of distribution frames in CO, DP, and AP points for termination of cable routes, passive network elements, and active devices, which the subscribers' junctions leading to individual

subscribers are connected to. The qualified cost also includes power junctions to such distribution board, if the power supply of active elements is necessary in this location for network operation.

-> *In compliance with EC suggestions, the use of PON technology is not recommended, and the development of such network type can be included in the qualified cost only in the event that the PON network configuration used has all optical passive elements situated in aboveground distribution boards and provided with connectors. Optical network (distribution and user type), which would use optical separators in individual cable couplings, welded directly to optical cables, is thus not included in the qualified cost, since this would complicate investment usability for its whole life span and limit the network use for wholesale lease.*

-> *MPO suggests grant recipients to become familiar with the document of the ICT Union "Methodology for the development of public infrastructure in electronic communications"*

1.9. Structural and technical parameters of the subscriber network

The NGA subscriber network serves for connection of the subscribers to an access point (AP) (see Fig. No. 1).

As the technological neutrality is required, the provider of subsidy support must allow access to the "High speed Internet" project to all operators of the electronic communication networks regardless the technology they use in the subscriber network's section. However, with respect to forecasted future development MPO supports in particular development of the network types of which baud rate may be increased up to 1Gbit/s in the next innovation steps (to the subscriber). Since different technological platforms pose various limitations, this document defines conditions for various types of subscriber networks so that they reflect best to the market situation and at the same time, no useless barriers to implementation of the new technological barriers are laid down.

1.9.1. FTTx networks

At present, this type of network is regarded as the most perspective for further development and therefore, MPO supports development of the subscriber networks. The networks are further divided into FTTH, FTTB, and FTTCab depending on the network topology at the subscriber.

-> **FTTH** (*Fibre-to-the-home*) network, an optical fibre is terminated (reaches to) a residential or business space of the subscriber. So far, appropriate gateway with metallic interface needs to be used at the subscriber for the service, however, since it is an active device, the gateway is not eligible as expenses from the state subsidy policy's point of view. Despite this time-limited (it is expected the market will provide the devices directly fitted with the optical interface) drawbacks, the development of this type of network is promising also from the point of view of potential use of WDM and DWDM technology, since this type of operation arrangement permits to open the infrastructure established in this way also for optical communication on other wavelengths, which will multiply the transmission capacity of the network with negligible additional investments.

-> As regards the structural arrangements, the eligible expenses for multi-apartment objects cover construction of a switchboard cabinet and internal cabling with fibres corresponding to

ITU-T G.657 A specification, whose placement inside a building permits installation of one or two optical fibres to subscriber's apartment, where at least one optical fibre in corresponding mechanical protection is terminated by an optical connector (usually SC-APC). The eligible expenses may also include reasonable expenses for interconnection switchboards inside a building, and energy hookups to the switchboards, if necessary for operation of the network. Should a potential subscriber refuse the connection, sufficient for eligibility of the expenses is termination of the cable reserve for the hookups in an appropriate plastic box on external wall of the apartment. Should a property owner refuse the optical fibre cable connection to each apartment, the subsidy receiver must install the optical cable of the subscriber network to the building (or base thereof) from the nearest access point or distribution point DP, or CO central station. The building supply cable must include at least the number of optical fibres equal to the number of apartments in the building, and the cable with at least 10m length reserve must be appropriately terminated in the switchboard cabinet inside the building or cable chamber on the external wall of the building or land with the building on it.

Should the property owner refuse the FTTH connection but insist on use of the metallic networks already existing in the building for connection, the applicant may use other technology for connection via the metallic network; however, the technology must comply with high-speed connection requirements in section IV hereunder. According to NPRSNG, however, the eligible expenses include passive components of the temporarily installed metallic network or construction adaptations thereof (until fully-fledged FTTH infrastructure is developed). This construction adaptation is regarded as compliance with the NGA network hookup for a building (depending on relevant number of households involved), and will be included in the eligible expenses. Additional development of the house network or upgrade thereof (after the subsidy project is cleared) is not included in the eligible expenses, and either the network operator or property (apartment) owner will cover the costs. Insofar as the receiver declares the connection as FTTH, the receiver shall at any time during network sustainability change the temporary metallic connection to the optical one (FTTH) upon presentation of consent of the property owner by the subscriber. Regarding the selection criteria (clause C8a) and scoring of the time-limited solution, this arrangement is included in the FTTH category provided that the condition mentioned above is complied with, i.e. in the building or land thereof, from where the metallic network to the apartments is installed based on request of the property owner, there is a number of optical fibres available from the access point allowing the upgrade of the building network at any time to 100% cover of the apartments in the building with the FTTH network, and at the same time the metallic network used in the building is not 100m+ long.

-> In case a family house is connected, the connection conditions and the construction procedure above apply accordingly, provided that at least two optical fibres must be installed for a single-apartment house, and at least 4 fibres are required for double- and triple-apartment house. Should the property owner declines connection to the optical network, minimum connection configuration with eligible costs is storing of sufficient cable reserve in a plastic cabinet at the border of the property with the house on, provided that the distance from the point of future additional installation is not farther than 30m. However, additional connection in the house is not eligible expense, and either the network operator or property (apartment) owner will cover the costs.

-> In case of the FTTH network with PON technology (*recommended only to expand the existing installations of this type*), **division up to level 1:32** is recommended with respect to potential future use of the network for operation at multiple wavelengths, wherein (mandatory provision) the dividers will be installed only in the overhead switchboard and connected with connectors. *In case of AON network, it is suggested that the active*

technologies are placed outside a residential building. In this case the eligible expenses apply also to electric hookup for the AON network switchboards where the active technology is installed.

-> **FTTB network** – (*Fibre-to-the-building or Fibre-to-the-basement*), the optical fibre does not reach the residential or business spaces of the subscriber. The optical fibre is terminated before these spaces, usually at the base of the connected property. After termination point of the optical fibre the network continues with different (non-optical) infrastructure e.g. CATV co-axial network with DOCSIS technology, or LAN metallic network. A couple of last tens of metres use the UTP cable in case of the follow-up metallic LAN network (at least CAT5 cable is required). We talk about the FTTB network defined in this way when higher number of residential or business spaces of the subscribers is connected. Disadvantage of the metallic LAN network is that the (usual) 100MbE interface of the subscriber network limits the baud rate at 100Mbit/s already on the physical layer of the Internet connection, which is okay for current technology status and the offer of network services, but it may be a bottleneck for the future. For the “High-speed Internet” project, which requires the network to establish real Internet connection with minimum baud rate 100Mbit/s through the replacement of the network active components only, provided that the follow-up 100BASE-TX LAN technology is used, the network may be regarded only as a network that satisfies the network parameters with 30Mbit/s access speed.

Therefore, the investor should consider whether is it more favourable for him to implement the 1000BASE-T technology on the follow-up LAN network and declare the FTTB network (naturally, provided that the throughput conditions for the distribution, connection, and backbone networks are met) immediately after the 100Mbit/s access speed, similarly to the most cases of the FTTH network. The implementation of both metallic follow-up LAN technologies may subject to state’s financial subsidy (but passive part of the network only) on the understanding that the price increment of own active 1000BASE-T technology is relatively negligible compared to the 100BASE-TX technology with respect to total costs for the metallic part of the FTTB network.

Therefore, the use of 100BASE-TX technology for the NGA networks developed (upgraded) with the state’s investment support is possible not later than end of 2020 where replacement for the 1000BASE-T technology will be required (see obligations in clause 1.1 above).

-> The subject of the support in development of this type of network is bringing of the optical cable to a building and its termination in an appropriate switchboard. The switchboard will include a router with (usually) GbE input interface and metallic outputs for 1000BASE-TX or 1000BASE-T network. However, the router is an active component and not included in the eligible expenses. For the FTTB installation is regarded as a subscriber’s NGA network with 30Mbit/s access speed, the FTTB router may have max 48 outputs (100BASE-TX or 1000BASE-T). The eligible expenses may also include reasonable expenses for interconnection switchboards inside a building, and energy connections to the switchboards, if necessary for operation of the network. The follow-up metallic network may not be longer than 100m and it may be included in the eligible expenses. In apartment of a potential subscriber the UTP cable should be terminated with a RJ45 connector socket (also eligible expenses), or a cable reserve in the common areas of the building will be maintained – the other options are similar to the FTTH network development, including potential inaccessibility of a specific apartment.

Should the subscriber network be declared as the 100Mbit/s access speed network, the number of GbE outputs on the router (switch) should not exceed 32 (1000BASE-T) ports.

Should the property owner declines connection to the FTTB, minimum connection configuration with eligible costs is storing of sufficient cable reserve in a plastic cabinet at the

border of the property with the house on, provided that the distance from the point of future additional installation is not farther than 30m.

Should the property owner require use of the existing network infrastructure for the connections, the infrastructure must comply with high-speed conditions according to section 4 of this document. According to NPRSNG, however, the eligible expenses include passive components of the temporarily installed metallic network or construction adaptations thereof. This construction adaptation is regarded as compliance with the NGA network connection for a building (depending on relevant number of households involved), and will be included in the eligible expenses. Additional development of the house network or upgrade thereof (after the subsidy project is cleared) is not included in the eligible expenses, and either the network operator or property (apartment) owner will cover the costs. Regarding the selection criteria and scoring of the time-limited solution, this arrangement is included in the FTTH category according to C8B provided that the conditions mentioned above are complied with, i.e. in the building or land thereof, from where the metallic network to the apartments is installed based on request of the property owner, there are optical fibres available from the access point allowing the upgrade of the building metallic network at any time to 100% cover of the apartments in the building with the FTTB network, and at the same time the metallic network used in the building (or between the access point and apartment of any of the subscriber) is not 100m+ long.

-> Contrary to FTTH, development of the FTTB network in family houses lacks purpose (a family house is usually regarded as one household – unless the building is a villa where one address consists of higher number of separated residential units), and in this case the metallic cabling for buildings with 2 up to (max.) 3 residential units is for the purposes of this project regarded as an apartment network whose development is not eligible expense, and it is recommended that in this case the FTTH configuration is used and evaluated under C8a of the selection criteria.

-> **FTTCab** (*Fibre-to-the-cabinet-FTTCab* or *Fibre-to-the-curb* network is a modification of the FTTB network, which differs in the fact the optical fibre is terminated in the switchgear (connection box) remote to the connected building(s) up to several hundred metres. For the purposes of the project, the FTTCab specifically links to modernization of the PSTN (public switched telephone network) metallic networks and DSLAM for the xDSL technology, an optical-metallic converter (usually router or switch) may be used (VDSL in most cases). For this type of network, the rules for eligible expenses applied above for FTTH and FTTB apply with the exception that the eligible expenses may in addition include the purposefully paid expenses for potential interconnection switchboards inside the building, and energy hookups to the switchboards with active technology.

Whereas xDSL is usually the follow-up metallic network from the optical interface, the rules for eligibility of expenses for development of this type of the follow-up network are specified in chapter 1.9.3.

The FTTCab network topology with follow-up xDSL technology (with the use of PSTN metallic network) may be regarded as a network according to C8b of the selection criteria if the length (of the longest) metallic line between DSLAM device and subscriber's apartment is under 100m even if the optical fibre is terminated (in the street switchboard) outside the residential building (cf. the conditions for evaluation of the FTTB configuration). Should length of the metallic line be longer than 100m (but shorter than 470m), the case shall be included under the C8c selection criterion.

-> some designs of the FTTCab networks are made and implemented so that the supply optical cable to the street switchboard (cabinet – connection box) is linked to the network infrastructure other than xDSL.

The examples of FTTCab according to the evaluation criterion C8c) include:

- (i) subscriber coaxial cable line suitable for provision of CATV services (DOCSIS technology) in case the follow-up coaxial metallic network contains more than one active component (e.g. distribution amplifier) between the optical/metallic converter in FTTCab and the network end point in the subscriber's apartment; or
- (ii) microwave technologies (operated based on individual permit or operated based on general permit if frequencies higher than 40GHz are used, e.g. 80GHz band in point-point topology in relation to the distribution optical access network (FTTA topology – Fibre To The Antenna); or
- (iii) wireless FSO technology – optical communication through free space in relation to the distribution access network with optical cables, if the conditions for high-speed connection according to section IV hereunder have been complied with. The eligible expenses include in compliance with NPRSNG the passive components of the follow-up network only.

1.9.2. Cable television networks (CATV)

The subscriber networks of this type are (similarly to FTTH) an isolated transmission medium with defined properties in relation to the surroundings. The CATV subscriber connections permit transmission of the signals in any part of the frequency spectrum from about 5MHz to about 1.5GHz.

-> **configuration of the CATV network** – similarly to the FTTx networks, the bidirectional data transmission (that permits the Internet connection services) is operated in the frequency multiplex so that the baud rate on the physical layer in one direction is independent on data transmission in opposite direction but on properties of the transmission path. In practice, this allows to cross over rather long distances (tens of kilometres on optical fibre, and kilometres with the use of coaxial cables) with the use of intermediate (bidirectional) amplifiers. The network designers may focus on optimization of the network topology with respect to multiple use of reserved part of the spectrum for transmission of data signals. In this way, the CATV network can connect individual groups of subscriber connections at summary baud rate up to 800Mbit/s forwards and 108Mbit/s backwards using current technology of Docsis 3.0 data transmission.

A typical configuration of a CMTS server (cable modem termination system) with 16 forward (128MHz) channels and QAM 256 modulation should not, to comply with a network of NGA parameters (in particular with respect to over-passing the limits higher than required asymmetry), operate 200+ subscriber connections with more than 96 active subscribers in case of a network with real baud rate 30Mbit/s. For a network of real baud rate over 100Mbit/s, it should not serve more than 48 active subscribers and 100 subscriber connections. This successively pushes the operators to the configuration of CMTS “stuck out” to the end of the distribution optical network where the coaxial subscriber connections have already been connected, which from the technological point of view corresponds to the FTTB network and GbE router with metallic 1000BASE-T ports. It is expected these types of networks will converge successively.

Higher permissible aggregation for subscriber connection on the CATV network (compared to other types of subscriber NGA networks) is the result of the fact that the subscriber has, in addition to IP, a connection for cable TV as well so that the volume of multicasting data

sessions is much lower for this type of network compared to full IPTV operation. This benefit of the CATV network is used also in case the IP connection of the DOCSIS system is shared (at the bitstream level) by other operator because there will remain a group of users that uses the CATV network for access to the linear TV. The burden of the IP technology with the CATV network will be always lower in practice when compared to the case there is no other way for receiving of the linear TV (via the NGA network).

Whereas the technology of the NGA network development is technologically neutral, MPO as the provider of the financial support for the NGA networks, may not rule out the use of higher forms of the data transmission systems (Docsis 3.1 and higher or – on the subscriber network only – MoCA system, and more). However, the state support for the NGA development focuses on passive infrastructure only and therefore, any use of other data transmission systems may be applied only in case of an appeal of other competitive service provider for allowing the network operator to wholesale access to the network either at the physical level in the form of provision of full capacity of a coaxial connection where no cable TV service is provided, or in the form of reserving a part of the transmission band for data transfer. In this case the above-mentioned MoCA system can be applied, however, virtual types of access to the developed NGA subscriber connection may be expected in practice (bit flow share or VULA system), which is associated with the fact the instructions from ČTÚ on conditions for making the network accessible under the wholesale offer do not impose a liability on the CATV network operator to provide physical access of the coaxial connection.

-> The conclusions mentioned above result in that the eligible expenses in case of development of a new subscriber network (the range of eligible expenses is substantially identical to FTTH and FTTB networks) may include expenses for development of power energy hookups to the switchboards that assume placement of an active technology and in general, all eligible expenses as specified in chapter 1.2 of this document.

-> The subject of the support for modernization of CATV subscriber network includes (similarly to xDSL networks, see clause 1.9.3) earth works (if needed for the modernization of the subscriber network), installation of switchboards and coaxial cables of the subscriber networks in the building (including installation of the subscriber sockets in subscriber's apartment).

-Should the property owner refuse the CATV connection but insist on use of the metallic networks already existing in the building for connection, the applicant may use other technology for connection via the metallic network, but the technology must comply with high-speed connection requirements in section IV hereunder. According to NPRSNG, however, the eligible expenses include passive components of the temporarily installed metallic network in the building or construction adaptations thereof. This construction adaptation is regarded as compliance with the NGA network connection for a building (depending on relevant number of households involved), and will be included in the eligible expenses. Additional development of the house network or upgrade thereof (after the subsidy project is cleared) is not included in the eligible expenses, and either the network operator or property (apartment) owner will cover the costs. Regarding the selection criteria (clause C8b) and scoring, the CATV network development is included in the FTTB category provided that the optical network terminates in a place where maximum one active component (e.g. house amplifier) is located between the optical and metallic converter and the network end point in the subscriber's apartment. Should the metallic part of the CATV network be more complicated and contains other active components in series connection, it is a network corresponding to FTTCab technology (clause C8c) with respect to evaluation of C8 clause in the selection criteria document. In the course of evaluation of the applicant's

project, the application for subsidy support for development (modernization) of the CATV network will be reviewed in the C8c selection criteria category, unless the applicant proves that some (or all) connections belong to the category according to C8b clause (e.g. by submission of the network scheme).

-> Should the connected building is a family house, an appropriate application of said structural procedures applies to the conditions for connection thereof, provided that termination of at least one coaxial cable per each apartment must be made from the access point where the converter between optical and metallic network is located. Should the property owner declines connection to this type of the electronic communications, minimum connection configuration with eligible costs is storing of sufficient cable reserve in a plastic cabinet at the border of the property with the house on, provided that the distance from the point of future additional installation is not farther than 30m. However, additional connection in the house is not eligible expense, and either the network operator or property (apartment) owner will cover the costs for the building.

-> In order the development of a new CATV network is included in eligible expenses, it is required that (as a pre-condition for future network upgrade for real access rate 100Mbit/s) the topology of the distribution optical network is designed so that the area in which the subscriber network covers max. 100 permanently occupied households, is connectable by a separate cable line (optical fibre), and the operation of CMTS system of DOCSIS 3.0 and higher is permitted, which is used for data connection of the subscribers only in this area and at the same time there is not more than one active component (usually house amplifier or "deep fibre node") between the optical and metallic interface of the network and end point of the network. Without complying with these conditions the network (in case the number of households per reserved optical connection exceeds said number) would not comply with the eligibility of expenses criteria for development of subsidized NGA network as defined by the subsidy support provider. For more details about the conditions the high-speed connection via the CATV must comply, refer to section IV hereunder.

The eligible expenses do not include development of new overhead metallic subscriber lines installed on supports (pillars) because the newly developed subscriber connections on the pillars should already be optical (see above – FTTx networks). However, this is without prejudice to the fact that the eligible expenses may include modernization of the existing overhead metallic lines, provided that their cable line does not comply with the requirements applicable to the NGA network. A receiver of the subsidy support must commit in his request for support to compliance with the EMC limits with other devices, which use radio spectrum in the CATV network operation location, or make sure the devices are not interfered by operation of the CATV network (and potential technological successor in the future), or the interference is removed at the expenses of operator of the NGA network.

1.9.3. xDSL networks –

A specific property of the xDSL networks is that they use already developed subscriber connections of the original analogue (PSTN) network for their function. In fact, it is not a development of a new network but upgrade of a part of the existing subscriber network. Whereas higher baud rate is achievable via the existing network on frequencies higher than those used by the analogue telephony, the decisive parameters are the line attenuation and cross talks between adjacent wires. Various technical methods may be applied to deal with these problems but the decisive factor is always necessity of shortening of cable lines of the subscriber connection. In order the network modernization investment is financially effective, it is necessary not only to change (shorten) length of the subscriber lines but also

(even not in all cases) to change the network topology because it was designed in the past to minimize length of the excavation works and not length of the subscriber connections. It is therefore likely that the projects for modernization of the subscriber network may include, if the xDSL technology is used, new installations (relocations) of cables of the subscriber connections. The provider of the subsidy support (MPO) therefore concluded that modernization of the network (in particular in structurally impaired areas with low medium density of inhabitants) is the investment at the level of development of the new access network in relation to the development of the FTTCab network. The network developed in this way should be governed as development of a new network, and throughput must be provided (as regards parameters of the physical layer) fully in compliance with the conditions for development of new and subsidized networks of high-speed connection as defined in section IV hereunder. Therefore the condition for eligibility of expenses is a guarantee for development of the new DSLAM components of VDSL class placed at a distance **not longer than 470m** (length of the line and not geographical distance!) from the farthest termination of the subscriber connection (network end point). This is, of course, associated with a request for interconnection of individual DSLAMs through optical distribution network. The modernized network thereby permits data communication following replacement of the active technology so far at access rate with a reserve over the required real rate 30Mbit/s, and for the future, the access rate on these subscriber connections can be accelerate over 100Mbit/s in connection with implementation of new technologies by mere replacement of the existing technology for the VDSL2, or G.fast, or other technologies.

From the point of view of the selection criteria (clause C8) and the scoring, the development of the FTTCab + VDSL network belongs in the category of networks by clause C8c, unless length of the metallic section of the network is shorter than 100m. In case of length of the metallic section of the network under 100m, this configuration has a sufficient reserve for additional development, and it may be evaluated under C8b selection criteria as already specified in clause FTTCab above.

-> The subject of the support is also development of appropriate switchboard cabinets (including electricity hookups) with corresponding components of the passive technology to which the subscriber lines are terminated (shortened), and provision of earth works where it is necessary to change the topology of the subscriber network to shorten the subscriber lines. However, the scope of the earth works should be minimized (to modernize the subscriber networks). The eligible expenses may also include reasonable expenses for interconnection switchboards inside a building, and energy connections to the switchboards, if necessary for operation of the network.

The eligible expenses do not include (purchase and installation) of active communication technology (DSLAM and CPE modem at subscriber). The eligible expenses do not also include development of new overhead metallic subscriber lines installed on supports (pillars) because the newly developed subscriber connections on the pillars should already be optical (see above – FTTx networks). However, this is without prejudice to the fact that the eligible expenses may include modernization of the existing overhead metallic lines, provided that the existing metallic line does not comply with the requirements for the VDSL2 technology transmission. A receiver of the subsidy support must commit in his request for support to compliance with the EMC limits with other devices, which use radio spectrum in the CATV network operation location, or make sure the devices are not interfered by operation of the VDSL2 network (and potential technological successor in the future), or the interference is removed at the expenses of operator of the metallic NGA network.

-> wholesale access to the network developed based on state subsidy will be allowed in the form of virtual access (VULA, or in the form of bitstream sharing) via the technology used by the xDSL network operator because access to the physical layer (metallic line) is technically not feasible due to cross-talks in the systems that use vectoring, or financially ineffective.

-> For more information about the wholesale access to the networks, refer to section V of this document.

-> **Regarding the use of overhead cable line in the urban zones of a municipality:** despite generally applicable Notice No. 501/2006 Coll. stipulates in § 24 that the energy networks and electronic communication networks are buried, MPO as administrator of the subsidy funds keeps, with respect to approval of eligibility of data, neutral opinion in this matter (applies to all infrastructure types of distribution and subscriber network in the urban zones of municipality), provided that the following conditions have been met:

- the subsidy receiver must have a building permit from a building authority and consent of the municipality for the overhead installations

- the subsidy receiver shall not make the overhead installations of electronic communication in that part of municipality where other lines (in particular energy lines) area already buried.

- the subsidy receiver shall not install the overhead electronic communications in a part of the municipality with 1,000+ inhabitants

- the permit from the building authority may be received upon an exception request from an administrative proceeding. The applicant for exception must submit a statement to the building authority together with the application that the overhead line of the electronic communication will be operated in the part of the municipality until and when the energy distribution is buried by the energy connection operator. The relocation of the overhead NGA network line under ground will not be regarded as eligible expenses under the support of development and modernization of the high-speed Internet connection networks

- upon request for payment (payment for the subsidy support under the eligible expenses) for installation of the overhead line, the subsidy receiver must submit the consent of the municipality, and submit the permit of the building authority with this type of the network installations.

1.9.4. wireless access networks

These are the subscriber networks that use radio transmission for the data transfer. Depending on focus of the connection and antenna systems used, the network may be operated in point to point (P-P) configuration, or point to multipoint, P-MP). In this case it is the radio communication between one base station and multiple subscriber stations.

-> **P-P type networks** can be in case of the NGA networks used as a part of both distribution and subscriber network. The P-P radio connection in the subscriber network is mainly used for the subscribers in business environment where quick installation and guarantee of the baud rate are required. Regarding the residential clients, the P-P radio connection is mainly used as temporary distribution connection for the systems of a LAN metallic network (see description of the eligible expenses for FTTB systems). In principle, the NGA subscriber network consists of the P-P radio connections operated based on an individual approach, fully accepted with respect to eligibility of expenses under the High-speed Internet project, and holding full protection against competition from other network operator. Of course, the

assumption of compliance with the required capacity and reliability of the operation must apply, which is the matter of selection of an appropriate frequency band, distance between both stations of single radio connection, and its transmission capacity in order to avoid the limitation of the baud rate and noncompliance with other key parameters (see section IV) at the subscriber. The eligibility of expenses for development of the P-P microwave connection as a part of the user network is conditioned by operation (use of the radio frequencies) of the connection based on an individual permit granted by ČTÚ or use of the P-P microwave connection operated in the 70-80GHz frequency band based on general permit, if installed upon approval of owners of the entities involved, and caused no interference to other, already operated microwave device upon commissioning.

-> **P-MP type networks** - the coverage of the Czech Republic by networks, which allow access to the Internet, is specific by high network penetration operated in so-called "licence-free bands" (use of the radio frequencies based on general permit), in particular in WIFI band (2.4 and 5GHz). This is, however, associated with lower reliability of the Internet connection parameters resulting from higher interference likelihood by the radio-communication channel used exactly due to the unlimited sharing of a part of the radio spectrum. Therefore, the development of the network may be regarded as eligible expenses only if the conditions mentioned below are satisfied.

-> **the matter of aggregation on user network of P-MP type** on the route between the base station (access point for WIFI, BTS networks for other types of the wireless network), and terminal device of the subscriber is one of the key parameters of the subscriber's connection made to the aggregation network. De facto, aggregation is the level of "multiple sale of unit of transmitted band to multiple applicants interested in communication at the same time".

Naturally, the question of permissible aggregation level relates to all IP networks, not only the wireless ones. However, whereas the P-MP networks are the "last mile" with respect to the shared transmission capacity on communication stretch, and because the P-MP networks are operated in the "licence-free mode" and interfered, the matter is discussed right here in 1.9.4. The value of designed admissible aggregation level depends on many factors, such as subscriber's behaviour on the Internet, types and methods of access to various converged services on the IP platform, and last but not least the width of the transmission data channel where data services for multiple subscribers are provided at the same time. If the aggregation value is too high, data transfer slows down as a demonstration of exhaustion of the allocated band of the data channel due to application of said factors. The radio interference together with the aggregation significantly contributes to exhaustion of the allocated band of the data channel. In addition to the influence mentioned above, the radio interference significantly involves in substantial deterioration of other key parameters compliance of which is required in the network (see section IV hereunder).

Therefore, despite the wireless access networks may use relatively wide radio channels with sophisticated methods of modulation and directional antenna system, the principle of use of valuable radio spectrum gives the operator of the system to control in a limited way (or even not at all), regulate, or provide declared connection parameters. The reason is in particular the fact that the system operator may not control how many subscribers want to share the radio channel at a specific point in time and what services will be used. Another cardinal reason is the fact that the system operator may not influence any has out of control the current (and variable) interference level within the used part of the radio spectrum.

Higher number of data transfer requests than capacity of the transmission channel results in conflicts and limitations of the baud rate including deterioration of other connection parameters. The LTE network is an example where – despite the typically used radio channel has the transmission capacity over 100Mbit/s and the network operates in the reserved

frequency band – high penetration of the subscribers in the area may cause drop in the baud rate down to a couple of Mbit/s. High aggregation level results in that the LTE network may not be regarded as the NGA type network because the NGA network is known for guarantee of the baud rate and throughput for reliable high-speed Internet access.

Similar (but in fact much worse because the network operator has all radio traffic in the shared band out of control) situation can be seen in the P-MP type network (point to multipoint) in the WIFI bands. The operator has better conditions for decision about who may or may not access the access point in this type of network because no mobile connection is provided for the subscribers (with the exception of railway stations, airports, malls, and more). However, due to required guarantee of the defined baud rate and throughput for reliable high-speed Internet access via the NGA networks, the transmission capacity of the radio spectrum in WIFI bands is insufficient (with the exception or extraordinarily sparse inhabited areas) for satisfactory area coverage of inhabitants in the territory covered by the wireless network. Among others, the use of radio channel with sufficient width needed to achieve the required connection parameters in the NGA network arouses high interference level in the same part of the radio spectrum in adjacent geographical area, in particular in the areas with higher settlement).

High interference level generated also by radio modems, in addition to the reasons of this situation mentioned above, in the used parts of the radio spectrum currently used with almost all types of the consumer electronic devices, which repeatedly attempt (without the user being aware thereof) to establish the radio connection. And then, despite newer (and more sophisticated) systems have been developed for data transfer in WIFI bands (e.g. IEEE 802.11.ac and other), their theoretical throughput increase (e.g. when MIMO antenna systems are used) drops in practice at the expenses of increasingly higher likelihood of collision (interference) with other radio transfers in this band.

The reasons for the connection throughput drop is, among others, include successive change to behaviour of an average subscriber, who uses the Internet connection that is related to the aggregation mentioned above. The volume of data communication constantly increases (40-50% each year now), which is associated with increasing volume of video transfer, use of the services of linear and non-linear TV transfer, and other advanced IP-based services. This is exactly where (watching of TV) the wireless networks fail as the means for the NGA networks because this type of operation requires a guarantee of permanent data flow with low transfer error rate (PLR under 10^{-4}), which may not be guaranteed in the wireless networks in long-term run.

Therefore, the wireless network for the Internet access according to the WIFI standard in P-MP configuration may not be regarded (with the exception mentioned below) as a perspective network with potential to permanently satisfy the requirements for reliable high-speed connection being the condition for the NGA networks.

Therefore, these network type may not generally be regarded (with the exception mentioned below) as the subject of support under the high-speed Internet connection networks development project, albeit they are declared as NGA networks (see clause 1.1), and based on radio coverage of a territory with the network made after CTO's data collection, which fixed the areas of Czechia's coverage as of 31 December 2015 and outlook to 31 December 2018, this may not block the network development in this territory in question that really satisfies the throughput parameters as required from NGA (e.g. FTTx network).

-> Having this full in mind, there are exceptions where the network operation for the wireless Internet access provided on a fixed point may be recommended, and in fact this

network may be regarded in configuration with P-MP as a network that complies with the NGA network parameters, and to include the same among the networks protected against competitive subsidized network of a different operator, and also the network, which may be the one developed with the subsidy support of the state based on assumptions of the technological neutrality.

According to expert analysis the network may be a situation where WIFI network, which uses the 802.11n, or 802.11ac (and higher) standard, and is operated as a public electronic communication network by a entity that is the holder of all legal permissions for development and operation of the network. Further, it must be made sure the network is used to offer services in a settlement area with not more than 150 address points and/or 100 inhabited apartments, provided that only one operator of the WIFI network operates here (receiver of the subsidy) that uses the radio frequencies based on the general permit for the network operation. The operator of the network defined in this way must be able to provide high-speed Internet access to any subscriber in the territory of said location at any time while supporting all services based on IP platform with at least baud rate 30Mbit/s.

In case of development of a new (or upgrade of the existing one) wireless Internet access network there is an exception where the P-MP technology, which uses the radio frequencies based on the general permit for the subscriber networks for the network operation may be applied, in particular in location with very low settlement ratio (e.g. mountain area with scattered cottages, or settlements shaded from the municipality centre e.g. by terrain wave) so that development of any other type network would be financially ineffective in these areas. In this case the subscriber network of P-MP type can be in extraordinary cases regarded as the subject of support under the NGA networks development project, provided that the following criteria have been satisfied at the same time:

a) transmission capacity of the wireless network (including limitation of throughput given by calculation of coverage of the territory, and considering the attenuation of spreading under bad weather) will be sufficient so that the network operator can warrant the network throughput based on the conditions required by NGA network and stipulated NPRSNG, i.e. make sure in advance the reliable provision of services while providing very high speed per subscriber and support of various advanced digital services including converged services fully consisting in the IP technology (i.e. including potential TV broadcasting transfer).

b) for the wireless Internet access networks, which use the radio frequencies for the network operation based on the general permit it is said that the territory covered by the wireless Internet access is not higher number of address points of the residential buildings than corresponding (while including the forecasted targeted 75% penetration) to the reliable transfer capacity of the applied wireless system. Based on expert review by MPO the limit is hereby defined to 75 address points of the residential building by the network, which should be able to satisfaction of the NGA network parameters of minimum speed 100Mbit/s. All provided that the territory where there is maximum number of address points of residential buildings, is divided from the interference point of view from the territory with another built-up area, e.g. by terrain wave, forest, or distance at least 1 km, and similarly to e.g. mountain areas where a municipality (or a part thereof) is covered in well closed valley area. That municipalities (their parts) are included in a database of white address places to define the intervention area and identified by the remoteness attribute 1 or 2. For places with the attribute 1, the remoteness condition is met by distance from other settled areas; for places with attribute 2 it is necessary for the applicant for subsidy to justify why the location is regarded as remote in the sense of this clause (isolated by a terrain wave, forest, and more). The locations with attribute 0 (higher than defined number of address places) and 3 (included in the build-up area of a larger municipality) may not be subsidized by the state for

the broadband networks operated in the licence-free bands (with the exception of the frequencies in bands higher than 30GHz).

c) connection (distribution) network, which is the source of connectivity for these wireless systems (but of course not only for the wireless systems – this applies to the full NGA access network) must have a throughput not to be a bottleneck for satisfaction of the NGA network parameters with relevant declared access speed.

When these criteria are satisfied at the same time the passive part of the infrastructure of the network may be included in the eligible expenses (e.g. for development of distribution optical network) at the level of target 75% coverage of the remote area by the NGA network.

Readers, who need to know why MPO restricts the possible inclusion of the wireless WIFI networks so popular in Czechia in the NGA networks category (both with respect to protection of investments in current networks, supported development of new NGA networks or upgrade of current networks), refer to MPO's website for technical analysis to support the MPO's decision. ([posouzeni_moznosti_wifi.pdf](#))

However, a network of wireless Internet access, which could be a NGA network (provided that certain assumptions are satisfied), can in summary be any other wireless network of P-MP type in case its transfer capacity in the subscriber network's stretch remains unlimited by slowing down the transmission due to interference caused by other signals in the frequency band used. A precondition for satisfaction of this condition is use of radio frequencies to operate the network based on individual permit from ČTÚ, or if the interference is effectively avoided by other equal organizational-technological-geographical measures. In addition, the network operator must be also able to guarantee its throughput at any time (achieving of real baud rate 100Mbit/s for any terminal subscriber not later than in 2020) while full satisfaction with NGA network requirements in NPRSNG document is retained.

A natural condition for the individual permit is that the wireless network must use the radio frequencies, channel masks, and modulations defined in the harmonization of the frequency bands according to NKT, PVRS, and related recommendations at the EU level.

That NGA network may be e.g. made from advanced radio-communication systems operated in the band of milometer wavelengths (over 30GHz) or FSO (Free Space Optics) optical systems, or combination thereof. Another option for solution of the NGA network may be e.g. wireless high-speed access systems of "mesh" type.

Hence and in full compliance with the goal, MPO as provider of the subsidy support for development of high-speed networks for the Internet access (NGA) reserves right to require, pursuant to Instructions of EC 2013/C 25/01, from the subsidy receiver to satisfy the requirements in this document as a condition for eligibility of expenses submitted to MPO under the "High-speed Internet" project support even in case the opinions of the applicant or subsidy receiver and/or other organizations may differ in the necessity of compliance with the conditions defined herein.

The wireless access networks that use frequencies based on the general permit for the stretch between the access point and terminal point of the network in subscriber's apartment will score no points under C8 of the Selection criteria. In case this stretch of the access network uses radio technology operated based on individual permit from ČTÚ, or technology in the microwave bands over 30GHz, this type of the access network shall be regarded as FTTCab for the purposes of evaluation according to C8c of the Selection criteria, of course, provided that the conditions of section IV hereunder are satisfied. To classify the radio access network (operated between the access point and NGA network's terminal point) as FTTCab (according to clause C8c of the Selection criteria) the network must have a

distribution network developed with the use of technology of a fibre optical network.

1.10. The settlement of easements with entities involved in the NGA network development

In compliance with provisions of § 104 of Electronic Communications Act, the subsidy receiver, who is a business organization in the sense of the act providing a public communication network, shall enter an easement agreement with owner of an involved property on placement of a device of public communication network (usually a cable line) prior to the construction works. This contract is usually a pre-contract on easement for one-off remuneration. The costs associated with required engineering activities defined by technical documents for conclusion of the easement contract as well as the costs for payment for the easement, and potential costs for compensation for damage of crops or forests (provided that damage of this type occurs during the NGA development) are included in the eligible expenses for the support project for development of the passive network infrastructure under “High-speed Internet access” project based on the following conditions:

-> the eligible expenses include the compensation for easements made pursuant to provisions of § 18 of Property Valuation Act No. 151/1997 Coll. provided that the costs for compensation for easement are usual at that time and on that place, and public space occupancy fees during the network development, if necessary

-> Provided that no new laws are enacted before implementation of the NGA network, which consider the rules on payment for the easements, the state subsidy receiver is recommended to apply the procedure recommended by the Ministry of Finance of Czech Republic in negotiations with the property owners: Comments to valuation of rights corresponding to easements – according to § 18 of Property Valuation Act No. 151/1997 Coll., dated 8 March 2011, issued by Department 26 MFČR, which makes recommendation related to the valuation of easements in construction of public energy networks, which equally to the electronic communication networks are the community infrastructure structures.

-> MPO as the provider of the subsidy support reserves right to limit the subsidy of the costs related to payments for the easements in case the subsidy receiver submits the requirements to the subsidy provider for one-off payments (easements) in the amount substantially higher than the usual price level at that time and on that place.

-> the eligible expenses do not include legal services and services from other providers delegated to negotiate with the property owners and to prepare the contract documents.

-> Upon request of the subsidy receiver, MPO shall ask the local governments of municipalities involved in the development of the high-speed electronic communication networks or other entities with majority property share of the state to consider according to the act transposing EU Directive 61/2014 the use of lands owned by them for development of the networks without the request for the easement compensation and property occupancy fee during the development due to the public interest, or granting a significant discount so that the payment covers demonstrable expenses only.

1.11. Network land survey and registration thereof in the Maps Register

Included in the subsidy receiver’s obligation under the development (upgrade) of the high-speed Internet access is mapping out the NGA network, and submission of the network

information to the state administration map register (**State Register of Passive Infrastructure and Maps of the Utility Networks – RPI**) as soon as established.

-> upon finishing of the development (of the project or of a phase if phased as approved by the subsidy provider), the subsidy receiver shall make as is design documentation for the network and its land survey mapping. This information is then stored (in electronic format and information structure required by the authority) in the map bases database not later than 60 days of commissioning of the network.

-> Engineering costs related to delivery of the as is design documentation and land survey of the network are the eligible costs in the development and upgrade of the NGA networks project.

-> In case the subsidized network is finished before codification of the RPI (State Register of Passive Infrastructure and Maps of the Utility Networks) rules, the subsidy receiver shall:

-> **Upon request** provide the authorized bodies with information about technical infrastructure of the high-speed electronic communication networks (hereinafter referred to as “TI-NGA”), which is an integral part of the project implementation documentation supported by 4 OP PIK priority axis.

-> In addition to requirements defined herein, being applicable to the subsidy receiver, the requirement is based on the existing obligation of the TI-NGA owners to provide information about territory and its update as specified in § 27, subsection 2 and 4 and 28 of Building Act No. 183/2006 Coll., as amended, and it is not restricted to the subsidy receiver only. The subsidy receiver may contact relevant building authority and ask for information about survey of positions of other providers of the public broadband electronic communications network, and to use the liability of the providers to provide the data about their networks to the subsidy receiver.

-> Another obligation of owners or operators of the TI-NGA emerged in relation with act on measures for reduction of costs for development of the high-speed electronic communication networks, which transposes Regulation No. 2014/61/EU of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks into Czech laws. The subsidy receiver is required to submit the TI-NGA survey data to relevant building authority and to the municipality where the deployment took place. The data provided shall be used in the information systems of the state administration under agendas and information systems of the state administration, and for sharing of spatial data of the technical infrastructure

-> Form of the provided TI-NGA spatial data

a) Information shall be provided in electronic formats **.dwg** and also **.dgn** on an optical carrier (CD, DVD)

b) Information must be provided in machine readable ⁴and open⁵ exchange format (hereinafter VF).

c) The public funds subsidy provider specifies the contents and structure of VF under the relevant call.

d) General validity of detail mandatory VF specification is submitted as of 1 January 2018.

⁴ § 3 subsection 7 of Act No. 106/1999 Coll. on free access to information

⁵ § 8 subsection 7 of Act No. 106/1999 Coll. on free access to information

Specification of required TI-NGA positional and elevation designation under VF

The subsidy receiver shall indicate for information about positional and elevation designation of the technical infrastructure:

- a) TI-NGA position from the as is survey, and elevation for the map bases of a large scale
- b) information in detail of the geometric survey in S-JTSK coordination system, and Bpv elevation system.

End of section I.

Part II.

2. Economic part - requirements for the economic parameters of the applicant and the recipient of the grant, submission of the application and termination of the project.

2.1. **An overview of the key parameters of the business plan that is the subject of the application for grant.**

The Call for Applications and Part I of this Annex to the Call sets out the requirements for submission of the documentation concerning the application for grant for the project of public electronic communications network enabling high-speed Internet access or for upgrading an existing public broadband network that does not have parameters of a next generation network (NGA) and does not allow high-speed Internet access. The minimum parameters for such NGA network are listed below in Part IV. of the Annex to the Call for Applications.

The reason for submitting documents regarding the economic parameters of the applicant's project is the request of the Grant Provider to be able to properly evaluate individual applications in the evaluation of multiple grant applications and to select the best recipient of the grant in a transparent selection procedure.

Subject to a possible grant under the project of construction (modernization) support for the networks, are only the investment costs, allowing to build (upgrade) the passive part of the NGA access infrastructure network, enabling the inhabitants of the Czech Republic to have high-speed Internet access, not active elements. This is related to the fact that active elements age much faster than the passive elements of the network (a prioritized high-speed Internet access network is - in line with the European Commission's opinion - a network consisting exclusively or mainly of fibre optics) and it is not ruled out that the active elements of the network will have to be replaced - due to the development of new services provided on the high-speed Internet access network - before the end of the "project sustainability period" that is set by the donor (EU) as a period of 7 years after the end of the project.

Although the MPO, as the Grant Provider, has a legal obligation to abide by a balanced approach to a variety of infrastructure and technology solutions for the construction of the NGA network, it is necessary to lay down the rules that each applicant for grant for the construction (modernization) of the network must fulfil so that his/her application can be compared with other applicants. Therefore, the MPO stipulates that the applicant must provide the following data ("project indicators") within the Application:

- a) The grant applicant is a vertically integrated operator providing access to the Internet⁶
- the area where the applicant is applying for a grant (the name of the Intervention Area, the name of the ZSJ, the number of ZSJ to be covered by the network)
 - the deadline for the project completion
 - the number of address points of residential objects in the Intervention Area that the applicant undertakes to cover by his NGA network within 3 years of signing of the Grant Award Decision
 - the number of all address points of residential objects in the selected Intervention Area

⁶ A vertically integrated operator is a legal entity that within a single legal entity acts in the role of network operator as well as in the role of provider of electronic communication services that are offered to the end users by means of this network.

- the number of already covered address points in residential objects in the NGA network of other operators according to Czech Telecommunication Office data collection, reflecting data as of 31 December 2015
- the indicative number of apartments in the said address points in residential objects which the applicant undertakes to cover by his network
- number address points in residential objects in localities where the separated part of the municipality⁷ has no more than have more than 75 address points in residential objects
- the number of address points in residential objects and indicative number of apartments in these residential objects, which after the construction of the networks according to the applicant's project will receive a new possibility of high-speed Internet connection, and which did not have this high-speed connection at the time of the CTO data collection date (31 Dec 2015)
- expected number of active (paid) connection lines (RGUs)
- the number of users of the Internet connection service to whom the applicant already provides the Internet connection service in this area
- the expected number of users to whom the grant applicant is likely to provide an Internet connection service at the end of the first year of its investment
- the expected number of users to whom the grant applicant is likely to provide a high-speed Internet connection service at the end of the second, third to tenth year after the start of the subsidized investment in the network construction (upgrade) in the area
- the expected price level (excluding VAT) for the lowest Internet connection service offer and the likely percentage of such an offer among the users
- the expected price level (excluding VAT) for the lowest Internet connection service offer that meets the NGA network parameters and the likely percentage of such an offer among the users
- expected revenues from the provision of Internet connection services (excluding VAT) on an annual basis for the first to the tenth year of network operation after the start of the subsidized investment
- expected revenues from the provision of other types of telecommunication services provided on the network which is the subject of grant support in the area and serves primarily to meet the needs of residential customers (e.g. a wholesale offer to other entities to provide their commercial services to end-users of the residential type, providing access to multimedia applications such as IPTV and OTT, providing public IP addresses, e-mail services, web hosting and other services that can be realistically expected as of the date of the application) and B2B commercial services providing high-speed Internet access or lease of network transmission capacity for this purpose, all on an annual basis (excluding VAT) from the first year to the tenth year after the start of the subsidized investment.
- the expected amount of bank credit that the applicant expects to acquire in order to cover its investment, a year of opened credits, the expected amount of credit resources, the due date (and, if applicable, the delayed maturity of the loan) and the interest burden. In the case you consider multiple credits, please specify these basic parameters of each loan separately.

⁷ For the purposes of the project to support the construction (modernization) of public electronic communications networks and with the objective of ensuring high-speed connection to the Internet, the "separate part of municipality" is considered as such a type of settlement where between the centre of the municipality and the separate part of the municipality or settlement is a distance of at least 1km and between the centre of the municipality and the separate part there is not a continuous block of residential or other buildings, and usually a separate part of the municipality or a settlement is also separate from the centre of the municipality by a natural obstacle (forest, valley, mountain ridge, river, etc.)

- the expected amount of own investment assets that the applicant is willing to invest in his / her network construction / upgrading project and the year of the investment, or the breakdown of the amounts for each year of construction and operation of the network.
- estimated total project cost (including the active elements of the network and the connection and distribution network).
- estimated total project cost (only passive part of the network, including the connection and distribution part)
- estimated average cost of one network connection line (per one address point in residential objects), including both the connection (backhaul) part and the distribution part of the network, as well as the estimated costs of covering the material burdens, but not the cost of the active elements of the network and CPE
- estimated total cost of active network elements - especially network costs and CPE costs
- estimated average cost of the active part of the network relative to one average connection line (per one address point in residential objects).
- estimated average costs of installing the network endpoint in the contractual participant's apartment, the installation and commissioning of the CPE and the ordered service
- expected average technical and economic life of the active network elements and the CPE (the beginning of the period when it is necessary to start renewing the active network elements and the expected end of this period).
- estimated average cost of ground work, length of excavation for cable laying, and average cost of ground work per 1km of route (especially in exterior and interior).
- total number of km of underground cable to be constructed.
- total number of km of overhead cableway to be constructed.
- total number of focus points to build
- total number of radio access points (focus points) to be built.
- expected additional investment costs for the construction of the passive part of the network in the annual breakdown (from the first to the tenth year of the construction and operation of the project), in particular:
 - o Project costs and investor supervision
 - o The payment of easements
 - o Payment of compensation for damaged crops
 - o Geodetic survey
 - o Registration of map information about the network in digital format into the map database register
- the required absolute amount of subsidy to the passive part of the network and the percentage of the grant in relation to all estimated eligible costs for the construction (modernization) of the network.
- estimated annual operating costs related to the operation of the network (1 to 10 years of operation), which is the subject of the project submitted. Specify in particular:
 - o Cost of service activities including spare parts (including CPE and service costs for end-users)
 - o Costs of electricity
 - o Cost of renting premises
 - o Cost of customer service and other costs (marketing, etc.)
 - o Costs of management of the applicant's company and other employees, including health insurance and social insurance
 - o Transport costs
 - o Accounting costs (even if outsourced to an external contractor)
 - o Costs of renting connectivity and renting networks of other operators
 - o Summary - total operating costs for each year of activity

- o Estimated return on total investment (years)
- b) The applicant is not a vertically integrated operator, but an operator providing only the operation of a public electronic communications network

- for such Applicant, all relevant economic disclosure requirements apply as stated above in point a) but he does not have to provide the model of the intended number of private end-users in residential buildings connected to his network in the area but he provides the estimated revenues and operating costs resulting from the expected contractual relationships with service providers that provide end-users with Internet access and other related services.

Please provide this information to the Grant Provider (MPO) in electronic form by filling in the table "Basic Economic Data on the Submitted Project" of the Applicant who applies for the grant from the OP PIK project, which can be found on the MPO website in the summary of documents relevant for the given round of the Call (the exact reference is given in the main document of the Call for grant support under this OP PIK project). (**cash-flow model.xlsx**)

An integral part of the full grant application is, in addition to the provision of economic information, a design study of the proposed network. The requirements for this design study are set out in Part III of this document, which is an Annex to the "Call for applications for grant to the construction (upgrade) of the Internet access network, which must ensure high-speed connection within the designated intervention areas of the Czech Republic".

c) Duration of the project, demonstrable ways of completing and accounting for eligible expenditure at the end of the project:

- Comparing the actual and planned end date of a project is crucial to determining whether the project's purpose has already been met and if it is possible to reimburse the final grant amount for the project. The recipient of the grant is obliged to complete the project no later than the planned end of the project according to the timetable in the Grant Decision. At the planned end date of the project, the recipient of the grant is obliged to meet the indicators obligatory for fulfilment, unless the Call or a separate part of the Decision stipulates otherwise and ensure that this fulfilment can be checked by the provider (or an agency authorized by him/her) or that it can be assessed, unless the program provides a different procedure. The actual date of completion of the project will be determined by the applicant in the payment request, taking into account the nature of the particular project. The actual completion of the project is considered as:
 - the date of the building occupancy approval, or, if no building occupancy approval is required, the date of the consent of the municipality with the repatriation of the land and property concerned
 - the date of issue of the Trial Operation Decision (this does not affect the obligation of the grant recipient to provide a building occupancy approval to the provider, which must be provided within 18 months after the actual completion of the project);
 - the date of putting the property into a state eligible for use in accordance with Act No. 563/1991 Coll. about accounting, in the meaning of Implementing Decree 500/2002 Coll. and 504/2002 Coll.,
 - the date of the last taxable event within the planned project conclusion,
 - date of actual fulfilment of the target value of the indicator(s) required to complete the project.
- if the Grant Provider has doubts about the completion of the project, it has the right to carry out on-the-spot inspections and to verify that the project has been completed.

2.2. Table of the Applicant's Simplified Business Plan, based on an assessment of the financial flows of the Applicant's business entity (the investor and the network operator) that is the subject of the grant application.

Please provide this information to the Grant Provider (MPO) in electronic form by filling in the table "Applicant's Simplified Business Plan" on the basis of the information in the previous chapter 2.1. of this document. You can find the table on the MPO website in the summary of the documents belonging to the given round of the Call (for the exact specification of the link, please refer to the basic Call for Grant Applications under this OP PIK project).

2.3. Profit and Loss Account for the Applicant for the past 2 years

Please send the profit and loss account of the legal entity applying for the grant for the construction (upgrading) of a high-speed Internet connection network (in electronic version) of the Applicant's business for the last 2 years. Use the data format according to Czech Accounting Standards. For this purpose, you can use the profit and loss account table, which can be found on the MPO website in the set of follow-up documents (see Chapter VI) relevant to the Call round. If the legal entity of the Applicant does not have such a long business history, the Applicant shall provide the Profit and Loss Account for the last completed accounting period.

End of Part II.

Annex: the file [cash-flow model.xlsx](#)

Part III.

3. Requirements for the project study.

The Applicant for the grant will attach a project study in electronic .pdf format, to the application, showing the plotting (in the map) of the network in the field, with a distinction to the types of infrastructure and the underground, aboveground or radio network, the number of fibres in the optical cables and the expected location of key network nodes (NNI), the place of connection to the backbone optical network, focus points of the network, etc. Unless the network topology with all the key nodes of the network is clearly visible from map data, it must also be accompanied by a drawing (in electronic form) of the network topology and its logic scheme. As part of the maps, it is not necessary to indicate the probable location of the cable route between the focus point and the address point of each residential object, but it is sufficient to provide a description and schematic solution of the standard types of connection installations.

3.1 Mandatory data.

Mandatory information is given in the previous Part II of this document. These mandatory data include the obligation to provide a statement of dimensions for the

construction of underground cable lines based on averaged prices per 1km of route (including easements) for the whole project of the Applicant within the intervention area.

3.2 Network infrastructure used

The applicant shall list all types of network infrastructure used in the project and the number of addresses points where the access network will be at the "last mile" level of the infrastructure to provide connectivity.

3.3 Number of address points of residential buildings.

The applicant shall indicate the number of address points of residential buildings and the number of apartments in the area served by one focal point of its projected infrastructure, the number of address points of residential buildings and apartments that are to be covered by the network and that are the subject of the grant application. Detailed data files of the address points used for assembling of the intervention areas (<http://intervencnioblasti.verejnakonzultace.cz/KeStazeni/nio.zip>) can be obtained if the applicant downloads this database:

<http://intervencnioblasti.verejnakonzultace.cz/KeStazeni/export-adm-kraje.zip>.

3.4 Method of connection and distribution network solution.

The Applicant shall indicate the network diagram, the length of the line, the location of the line, the interconnection points and, in particular (in accordance with the information in Part II of this document), the following data in the design study:

- the total number of km of underground cable to build
- the total number of km of overhead cableway to build
- the total number of focus points to build
- the total number of radio access points (focus points) to build
- how to power the active elements, the number of electricity supply points, and whether the power is backed up
- what capacity is reserved for potential applicants for network rental within the wholesale bid - the applicant shall indicate the fibre counts in the network optical cables in the area
- whether in the project the network connectivity and distribution routes are backed up by means of the communication redundancy of the line. If yes, it is necessary to state whether the backup is automatic or if manual switching is required.
- whether the network operation will be monitored in continuous operation.

End of Part III.

Part IV.

4. Required parameters of NGA networks, assessment, measurement and evaluation methodology

4.1. **Definition of NGA networks, required connection speed, parameters, authentication, service quality.**

The definition of NGA networks is described in the NPRSNG document and it describes the NGA networks, in a simplified way, as high-speed Internet access networks that are capable of providing a reliable connection to the point where the network operator accesses the public Internet (peering centre).

-> **The existing NGA network**, that will continue to be protected under OP PIK program must meet at least the following criteria:

- a) the network must enable the user to have reliable high-speed Internet access and access to services provided at a real (commercially available) connection speed of at least 30 Mbit/s in a forward direction (from the network to the participant)⁸ whereas the availability of this speed must be at least 95% of the time all the day.
- b) via the network, it must be possible to reliably provide services with guaranteed availability and quality, including support for a variety of converged IP-based services. An existing NGA-category public network that was built prior to the release of this Guide does not have to meet the parameters required for subsidized NGA network construction set up for the transmission of IPTV and OTT video services, unless the services are commercially provided to the network in question and the network operator has demonstrably informed his customers (participants) about it.

-> New NGA network

A new or possibly upgraded network that may be the subject of a grant is a NGA network meeting the following criteria:

- a) the network must allow the use a reliable access to high-speed Internet access and to services provided at a real (commercially available) forward rate (from network to the user)⁹

⁸ For real (commonly available) speed, the transmission rate on the L4 layer according to the OSI model is obtained by measurement, among others.

The commonly available speed as defined by the BEREC European Regulators Association: (i) Commonly available speed is the speed which the end user can expect most of the time during the use of the service. BEREC considers that commonly available speed has two dimensions: numerical expression of the speed and availability of speed over a specified period (as a percentage), such as peak or whole day. (ii) Commonly available speed should be available within a set daily time period. National regulatory authorities may specify requirements for the definition of commonly available speeds as referred to in Article 5 (1). An example is: the specification that commonly available speeds should be available at least at off-peak and 90% peak times, or 95% the whole day;

at least 100 Mbit/s, or speed at least 30 Mbit/s, if an increase to at least 100 Mbit/s will be possible by mere exchanging or upgrading the active elements by the end of 2020 at the latest.

- b) The real (commonly available) connection speed in reverse direction (from the user to the Internet) must be at least 33 Mbit/s or 10 Mbit/s if the increase to a minimum of 33 Mbit/s will be possible by simply replacing or upgrading the active components, by the end of 2020 at the latest.
- c) via the network it must be possible to ensure wholesale access to the subsidized physical infrastructure and data flow, thereby promoting competition in the electronic communications market in the locality, within the meaning of Commission Regulation (EC) No 2013/C25/01 in this matter pursuant to Part V of this document.
- d) via the network it must be possible to provide services with guaranteed accessibility and quality, including support for the various converged IP-based services provided in the sense of the Annexes of the NGA Support Program Challenges (OP PIK 4.1).
- e) Real-time availability shall be at least 95% of the time throughout the day.
- f) The lowest possible value of the minimum speed to which the NGA service provider can commit, in case of NGA networks, is 50% of the available speed.

For the purposes of assessing the eligibility of "High Speed Internet" expenditure, the real (commonly available) speed is calculated according to the volume of data over a certain period of time¹⁰. Thus, the real rate of transmission in NGA networks can be approximated by a calculation based on the size of a data file that is downloaded from the NIX-interface-connected test server via the NGA network so that when downloading a given data file (usually within a few MB) the file was downloaded over a time period from which you can calculate the baud rate according to the formula:

transmission speed = given volume of data / time required to download the given data volume

The result obtained by the above way of measuring speed - de facto this is the calculated average transmission rate (when calculating it should be taken into account that a byte (B) is 8 bits) - for the purposes of the project "High-Speed Internet", it is considered to be "real speed", which is the term used by the NPRSNG document. Otherwise, this way of determining the baud rate can also be referred to as the commonly available (or guaranteed average) speed of the high-speed Internet access network connection. Frequently available is the speed at which the end user can expect most of the time while using the service¹¹

This means that if there is a transmission slow-down over a certain period of time (assuming continuous testing for several minutes at any time during the day and assuming a similar load on the other user lines within one focal point), then in a different time period the transmission rate should be higher, in order to achieve overall data transmission, corresponding to the required minimum limits 30 or 100 Mbit/s.

Another parameter that the new NGA network needs to meet within the project's sustainability timeframe (at the same time it is necessary to meet all of the above conditions) is the adherence to the minimum guaranteed speed. The minimum speed is the lowest rate that the internet service provider undertakes to provide to end-users under a contract to provide an Internet

¹¹ BEREC-ENNR, BoR(16)127, article 147

access service¹². If the current connection speed is lower than this minimum Internet access service speed limit (except when the internet access service is interrupted), and the deviation can be characterized as large, persistent or recurring¹³, it means not meeting the required minimum speed parameter.

Such a connection (or network) cannot be classified as a NGA connection (network). This parameter is set with regard to the requirement that TV broadcasting via IP line must be without interference with the TV broadcast (subject of other conditions, especially transmission errors, of course). The lowest possible value for the minimum speed to which the NGA service provider can commit is 50% of the commonly available speed. Since the transmission speed is derived (according to the formula mentioned above in this chapter) from the volume of data downloaded at a given time unit, therefore the so-called data "overhead" is not included in the measurement. This is the transfer of service data exchanged among the different technologies connected in the network they control, thereby enabling the operation of the data communication system (various headers, labels, signalling, etc.). Therefore, only the "pure data" volume is measured, not pure data together with the internal system data of the network. It follows that when measuring the speed, only the data transferred in the L4 layer (transport layer according to ISO/OSI) must be taken into account.

However, since the amount of data communication on the L1 layer (Physical layer according to ISO/OSI) is thicker due to the transmission system "overhead", and for example also due to duplicate data (if there are errors in data transmission in TCP IP), it means that the transmission speed measurement (based on the recommended methodology in Chapter 2) on the transport layer L4 will always be lower than the data transfer rate on the physical layer L1. This prevents, for example, the use of the 100BASE-TX (Fast Ethernet) technology with 100Mbit/s limit transfer rate on the physical layer in a FTTB network. In order to meet the required 100Mbit/s real transmission speed on the transport layer and to provide a 100Mbit/s real transmission rate, the 1000BASE-T (1GbE) technology is required on the user part of the FTTB network. In this context, account must also be taken of the situation whereby the network operator allocates some data streams (such as IPTV) to a separate VPN data "tunnel", because in such a case, this division must be respected and the data speeds must be added in the common data channel and the VPN channel.

Based on the NPRSNG definition, the ratio between the data permeability (real transmission speed) in forward direction (from the peering centre to the user's) and reverse direction (from the customer to the peering centre) must be no more than 3:1 for subsidised NGA networks, therefore, the speed minimum real transmission speed corresponding to the definition of high-speed connection (NPRSNG) on the NGA network must be at least 30Mbit/s in the forward direction and 10Mbit/s in the reverse direction. These are also recommended parameters of the lowest commercial offer that complies with the nature of the high-speed service for residential customers (including other recommended parameters - see chapters 4.1.1 and 4.1.2). This does not preclude customers whose Internet access service is not a high-speed connection from being connected to the NGA network, unless they demand such high-speed connections (for example, they signed a contract for connection at a lower rate before the network upgrade).

In the event that the NGA network operator decides to offer to the customer a higher transmission speed than 300Mbit/s in forward direction, the operator is not required to provide the residential customers in the reverse direction with a higher real transmission speed than 100Mbit/s.

¹² BEREC-ENNR, BoR(16)127, article 143

¹³ A requirement of MPO based on the recommendations for implementation of ENNR BEREC,

4.1.1. Qualitative parameters of NGA networks - methodology for NGA network measurement and assessment

In the context of assessing the NGA network membership and the eligibility of expenditure submitted in the application for financial support, two types of networks will in principle be considered:

-> **existing NGA networks** (already in existence on 31 December 2015) and financed exclusively from private business assets. These networks are subject to protection and they cover areas that could otherwise be covered by a new NGA network with higher quality parameters built with state support. Based on the discussions of the MPO, the CTO and the business sector, it was decided that for these existing networks declared by their operators as NGA networks during the data collection, their recommended minimum parameters (in addition to the required real speed) must be met so that these networks could really be considered as NGA networks and could be protected against possible competition from operators of subsidised NGA networks.

Required minimum parameters for pre-existing (non-subsidised) high-speed Internet access networks (except the required speed) according to the CTO methodology:

<u>Parameter</u>	<u>Required value</u>
Delay – one way	≤ 37 ms
Delay variation	Not defined in this document
Packet loss rate	≤ 10 ⁻³
Availability	Not defined in this document

Tab. No. 5 – Set of rules for stable operation according to MEF 23.1 - PT 1 – CoS Low

On top of the above minimum required parameters there is also a requirement to ensure maximum possible aggregation that will be adequate to the common Internet traffic without significant share of video services, therefore with a coefficient of the increase of steady flow (according to the CTO methodology $C_T=0,005$ at 0,01 Mb/s/user).

Communication of the Grant Provider to the operators of the existing public electronic communications networks identified in the data collection as NGA networks: For existing networks, which are, based the declaration of their operations during the CTO data collection about coverage of the territory of the Czech Republic (during 2016), considered as high-

speed connection and at the same time do not meet the above mentioned minimum parameters, supplemented by a reliable internet connection condition, providing a transmission speed of at least 30Mbit/s in the forward direction and where it is therefore not possible to reliably provide advanced IP-based services such as Cloud computing, linear and multimedia services, especially in HD resolution, and other similar services, their operators must, in order to secure the protection from the competition of the subsidised operator (investor), inform by 30 September 2017 demonstrably the users using the Internet connection via their network, that this network does not support reliable provision of advanced IP-based service, as listed (in this article) above and also they must inform MPO about their commitment to modernise their network by 31 December 2018 so that it complies with reliable Internet connection with forward real transmission speed at least 30Mbit/s and at the same time so this NGA network fully supports provision of advanced IP-based services in line with the requirements of NPRSNG and the Guidelines EK 2013/C25/01 in article 58.

If they fail to do so and if it is proven that this network (networks) repeatedly does not meet these requirements, especially if it is proven that through such network (networks), clients are offered commercial access to advanced IP-based services (as in the above example) that the network is unable to provide reliable due to limited capabilities of the network, the MPO as the Grant Provider, has right, in accordance with the provisions of Article 65, to cancel the protection of such networks, and is entitled not to consider such a network as a NGA network, with all the associated consequences.

Such obligations, in accordance with the reasons set out in Article 65 of the EC Guidelines 2013/C25/01, apply in full extent also to the networks that were put into operation (their coverage was extended) in the period from 1.1.2016 to 31.12.2020 and whose operator in the data collection organized by CTO declared them as broadband networks (NGA). Newly built NGA networks (so that they can be put under the programme OP PIK 4.1 as protected networks) must meet the requirements set in CTO methodologies for the measurement and assessment of NGA networks and must be able to ensure reliable operation of advanced IP-based services, with adequate forward speed 30Mbit/s such as Cloud computing, linear and non-linear media services (especially in HD) and other similar services.

-> **NGA networks whose construction (upgrade) is the subject of financial support** in the framework of the project “High-Speed Internet”

A network of high-speed Internet connection, whose construction is subject to financial support from the state, must fulfil the obligations set out in NPRSNG and in the Call for Applications and parameters of these networks must, at the time of commissioning, at least meet the parameters set out in the CTO Methodology (method of measurement and assessment of NGA) and must be able to provide reliable internet connection with a transmission speed of at least 30 Mbit/s in the forward and 10 Mbit/s in the reverse direction.

The operator of the subsidized network must also ensure reliable transmission of advanced IP-based services, corresponding to the forward speed of 30Mbit/s, such as Cloud computing, linear and non-linear media services (especially in HD) and other similar services to all participants, who show interest in such service and who sign a contract with the service provider (or directly with the network operator, if the grant recipient is a vertically integrated provider of a public electronic communications network).

From January 1, 2021 the subsidized network operator must be able to provide reliable Internet connection with a transmission speed of at least 100 Mbit/s in the forward direction and 33 Mbit/s in the return direction (on the layer L4 according to the OSI model). The operator of the subsidized network must also ensure reliable transmission of advanced IP-based services, corresponding to the forward speed of 100Mbit/s, such as Cloud computing, linear and non-linear media services (especially in HD) and other similar services to all participants, who show interest in such service and who sign a contract with the service provider, or the network operator.

Required minimum parameters of networks built (upgraded) with the use of state subsidies (except the required speed), taken from the CTO Methodology, valid from the beginning of their commissioning

Parameter	Required value	Tolerated value
Delay – one way	≤ 20 ms	≤ 25 ms
Delay variation	≤ 8 ms	≤ 15 ms
Packet loss rate	$\leq 10^{-4}$	$\leq 10^{-4}$
Availability	Not defined in this document	Not defined in this document

Tab. No. 6 – Code of stable operation according to MEF 23.1 - PT 1 – CoS Medium

If the grant recipient fails to ensure the specified network parameters and the failure of these parameters will result in a complaint by any of the users connected to such a network due to the inability of high-quality and reliable services, the Grant Provider (MPO) has the right to penalize the subvention recipient in accordance with the rules of the OP PIK.

The requirement for reliable provision of advanced converged IP-based services (video, IPTV, etc.) leads to significantly more stringent requirements to the maximum possible aggregation. Aggregate curve should be constructed so that the figures mentioned in the CTO Methodology shall be respected fully with a reserve. The main reason is that for newly constructed networks it is crucial to provide reliable access to all the advanced IP-based services (real-time services such as TV, Cloud computing, or “other services”¹⁴)

¹⁴ BEREC – ENNR, BoR(16)127

Therefore the Grant Provider demands from the subvention recipient that newly constructed (modernized) networks shall be, at start-up and during the whole sustainability period, able to provide all customers with high-speed Internet so that customers feel no restrictions in the use of advanced IP-based services, which leads to the requirement that the grant recipient shall design his/her network and then gradually modernize it in such a way that during the operation of the network there is respected the gradual increase coefficient of the data stream C_T [MB/s/user], so that such a reliable broadband Internet access at the set speed is fully guaranteed - even in the event that any (or all) of the participants uses this connection to access the advanced services (Cloud computing, multimedia services, including IPTV, or other similar services).

In connection with this, MPO as the Grant Provider encourages the grant recipients that they should, in their own interest, design the project so for the aggregation curve course there is used the steady flow increase coefficient in the network at least $C_T = 0,2$ Mb/s/user whereas he/she must be ready that in the second half of the sustainability period he/she will probably have to further decrease the aggregation in the network by gradual increase of the steady flow increase coefficient value (to the expected values $C_T = 0,4$ Mb/s/user and more) thus preventing overload of the network and the IP technology during peaks.

Note: the value $C_T = 0,005$ Mb/s/user represents the volume in average ca 1,5GB data monthly (it is common for users of mobile data connection), $C_T = 0,2$ Mb/s/user represents ca 65GB downloaded by an average customer monthly and $C_T = 0,4$ Mb/s/user represents ca 130 GB monthly. Although this indicator is not quite representative, statistically it describes very well the average behaviour of customers in the network. For a quick overview of the estimated course of the aggregate curve, MPO provides an orientation table of the number of customers, available speed and the required allocation of transmission capacity for the current type of behaviour of the average customer in an NGA network type:

Ns	Ap	As	A	Hz[Mbps]		
				10	30	100
				Hn[Mbps]		
1	1,000	0,00	1,00	10,00	30,00	100,00
2	1,489	0,20	1,69	16,89	50,67	168,89
5	1,999	0,80	2,80	27,99	83,97	279,90
8	2,229	1,40	3,63	36,29	108,86	362,85
9	2,284	1,60	3,88	38,84	116,53	388,43
10	2,334	1,80	4,13	41,34	124,01	413,37
12	2,419	2,20	4,62	46,19	138,56	461,86
15	2,522	2,80	5,32	53,22	159,65	532,18
16	2,552	3,00	5,55	55,52	166,55	555,16
17	2,580	3,20	5,78	57,80	173,39	577,96
18	2,606	3,40	6,01	60,06	180,18	600,61
20	2,655	3,80	6,45	64,55	193,65	645,48
30	2,844	5,80	8,64	86,44	259,33	864,44
40	2,982	7,80	10,78	107,82	323,46	1078,19
50	3,091	9,80	12,89	128,91	386,73	1289,11
60	3,182	11,80	14,98	149,82	449,47	1498,22
78	3,317	15,40	18,72	187,17	561,51	1871,69
100	3,449	19,80	23,25	232,49	697,46	2324,88
128	3,585	25,40	28,98	289,85	869,54	2898,46
200	3,844	39,80	43,64	436,44	1309,31	4364,38
256	3,996	51,00	55,00	549,96	1649,87	5499,55
306	4,109	61,00	65,11	651,09	1953,28	6510,93
500	4,442	99,80	104,24	1042,42	3127,25	10424,17

780	4,770	155,80	160,57	1605,70	4817,09	16056,97
1000	4,965	199,80	204,77	2047,65	6142,96	20476,52
2595	5,809	518,80	524,61	5246,09	15738,26	52460,86
4504	6,373	900,60	906,97	9069,73	27209,18	90697,28
10000	7,306	1999,80	2007,11	20071,06	60213,17	200710,56
Ct =	0,2					
GB/ user/ month	64,80					

Tab. No. 7 – illustrates the relationship between the number of users (Ns), connection speeds allocated to them (10, 30 and 100 Mbit/s) and the estimated value of the required connectivity. This table is prepared for the current customer behaviour on the network with unlimited access to data and multimedia applications. It is expected that in the course of about three years the same number of customers will need approximately twice the transmission speed.

The transmission capacities that can be realized in a single locality by WIFI technologies 802.11n and 802.11ac are marked in yellow.

4.1.2. Parameters operation reliability of NGA networks (SLA for end user of residential type)

In accordance with the purpose expressed in NPRSNG, the MPO demands from the network operator, who is a recipient of a subvention for the construction (upgrade) of a NGA network, to meet the conditions ensuring operational reliability of subsidized networks. Fulfilment of these conditions has a direct impact on the level of reliability of the services for the end users (SLA). SLA conditions for wholesale customers, utilizing the recipient's obligation to provide access to his network also for other providers of high-speed connection, are set out in Part V.

Although the provider of high-speed access to the Internet via a public electronic communications network may be a different legal entity, the recipient of the subvention and the network operator is bound by the terms and conditions to ensure, at least during the sustainability period of the project, operation of the network under the terms set out in the document NPRSNG, requirements of CTO, general legislation and, finally, the conditions expressed in this document.

One of the key obligations of the network operator, who is the recipient of grant support for the construction (upgrade) of NGA network, is to propose and implement new (modernized) network so that throughout the sustainability period of the project he would be able to provide all the advanced electronic communications services whose provision will be gradually demanded by the operators offering high-speed services and utilizing the recipient's obligation to provide them with access to his network (see "wholesale access").

In relation to commercial residential customers, the grant recipient - if it is a vertically integrated company and is therefore at the same time both the network operator and the service provider – must ensure the following during the project sustainability period:

-> **the availability of services in the high-speed network for residential customers.** The fulfilment of this condition involves two factors. Firstly, it is necessary to meet the conditions of the network permeability, i.e. access speed that is set in the NPRSNG documents, coupled with the requirements specified in chapter 4.1. of this document and the rules of qualitative parameters of NGA networks - see chapter 4.1.1. Secondly, the time availability of services

must be ensured. In this area, the MPO demands the following, as a condition for eligibility of expenditure in the construction (upgrade) NGA network:

-> **availability of the service**, for whose provision there must be met the minimum requirements of NGA network quality (chapter 4.1. and 4.1.1.), must be at least 98% of the time during a calendar month, regardless of the time of day, except that the time of availability does not include the time between 01.00 and 05.00 at night, when the network operator is entitled to suspend the operation of the network at most 1 x monthly to carry out the necessary planned technical changes to the network, testing of new technology **and so on**. The network operator must inform the service provider about any planned suspension of operation at least 48 hour in advance and the service provider will ensure informing of his customers, at least 24 hours in advance, about the planned suspension of service, by an email or at his website. Other suspensions of service will have the character of accidental interruption of service and they are subject to the 98% availability condition as stated above, which with excluding the time periods discussed in this article, represents max 14 hours in one calendar month, when a single user line can be out of order. This time does not include service interruption caused by the customer (damage or destruction of the connection line or active devices in the apartment of the customer (CPE), which are a precondition for the provision of services (including disconnection from the power supply). Reported service error must be remedied by the operator within 2 working days of reporting the error. In case of inaccessibility of the error location, the course of the time period, required for the error repair, shall be interrupted for a maximum of two more working days. This does not apply if the inaccessibility of the place of the defect is caused by the absence of the customer. In the event the network operator (the service provider of broadband internet access is the one responsible for the provision of services to the customer) exceeds the deadline for removing the defect, the participant is entitled to demand that the network operator provides a proportionate discount for his service during the following 30-day operating period. The network operator can avoid this obligation to the customer only when the interruption of services occurred due to Force Majeure, which could not have been foreseen, or where the interruption was caused by the service provider.

4. 2. CTO Methodology for measuring and evaluating data parameters in fixed electronic communications networks

One of the major objectives of the strategy defined by the document NPRSNG is to ensure compliance with the rules of equal and non-discriminatory treatment in the provision of Internet access services and particularly the related rights of end users¹⁵ as required by the Regulation of EP and EU Council 2015/2120 dated 25 November 2015“.

Fully in line with this objective, MPO as the provider of grant to the construction of high-speed networks for Internet access (NGA) reserves the right, in accordance with the EC Guidelines 2013/C 25/01 to require the recipient of grant to meet the requirements specified in this document as a condition of eligibility of expenditure submitted to MPO within the application for financial support for the project "High-Speed Internet".

For this purpose, MPO elaborated internal methodology "Administrative control of quality parameters of electronic communications network" (hereinafter as "Methodology") with which it is possible to familiarize here:

¹⁵ section 116. of the BEREC guidelines on the execution of European rules of net neutrality as maintained by national regulation authorities

Note: This is an internal material that is not annexed to the Call and is provided for information only.

Administrative control the quality parameters of the network is the first part of the authentication process in which it is determined whether the network under consideration is theoretically able to achieve the required or declared parameters. The second part of the authentication process may be actual measurements of the required or declared parameters, which is executed by the procedures described in the CTO Methodology.

MPO as the Grant Provider can contact CTO with a request to perform the measurement of the network or it can ask another authorised entity to carry out this task. In the event that MPO will demand a measurement of the network, this entity will proceed in accordance with the act No. 255/2012 Coll., on the inspections (inspection rules) as amended, and ac No. 127/2005 Coll., on electronic communications and about changes in certain related acts, as amended.

The recipient of the subvention must take note that the set of parameters specified in this internal document of CTO (Methodology for measurement and evaluation ...) can evolve over time.

Hypertext link to the CTO Methodology: [metodika-pevne-site-ctu-12-16.pdf](#) or also [here](#).

www.ctu.cz/sites/default/files/obsah/stranky/937/soubory/metodikapromereniavyhodnocenidatovychparametrusiti.pdf

4.3. Conclusion and summary

Measuring of the network according to this methodology is generally performed by CTO. However, in case of verification (especially on the basis of complaints of customers connected to the network) of NGA networks that have been built (or upgraded to a state of NGA) with state subsidies, or networks that already exist or will be gradually built in areas reserved for this purpose to private operators for 3 years under the provisions of the EC Guidelines 2013/C25/01 and have been declared as NGA, but there is a reasonable suspicion that they do not meet parameters of NGA networks, MPO as the Grant Provider has the right to decide to entrust such activities either to its employees or to contractor. All workers who take part in such a measurement and verification must be trained for this activity, based on collaboration between MPO and CTO, by CTO personnel who have a proven knowledge. CTO will provide cooperation to MPO for this purpose and will provide the measuring server. The results of such measurements will be used by the Grant Provider (MPO) to make decisions in the matter of the subventions procedure and a copy will be provided to CTO for comparison, verification or archiving. The customer will be able to use the results obtained by this method to file a complaint about the EC services.

End of Part IV.

Part V.

5. Wholesale offer - CTO guidance for the creation and publication of the wholesale offer of access to NGA networks built under the grant program "High Speed internet".

5.1 Introduction – basic principles

One of the basic conditions for drawing grants under the grant program "Broadband Internet" is to provide wholesale access to the infrastructure that is built using subsidies, on the basis of a mandatory wholesale offer. For this purpose these Guidelines were prepared, in accordance with the requirements of the relevant European documents¹⁶ and with regard to the conditions of the grant program and related Calls, they set specific requirements from the creation of such a wholesale offer to provide wholesale access and its publication and in the form of a referential offer.

The purpose of the wholesale offer is to allow the Applicant an effective wholesale access to infrastructure, in cases where construction of this infrastructure was fully or partly financed from public funds under the program OPPIK.

Wholesale access to the subsidized infrastructure must be offered and provided under non-discriminatory and transparent conditions so as to take account of the principle of technological neutrality and proportionality. Wholesale access must be in the form of a wholesale offer offered to all entrepreneurs who are authorized to do business in electronic communications by Act No. 127/2005 Coll., on electronic communications and amending certain related acts (the "Act"). The wholesale offer must be offered to eligible candidates under non-discriminatory conditions both among each other and also in relation to the services offered by the very recipient of the subvention, even for use to resell the services of the provided access. The purpose of providing the wholesale access is to provide publicly available services to end users by other businesses using this wholesale access.

Wholesale access to the subsidized infrastructure should be offered for at least 7 years and in the case of passive infrastructure (see below) this wholesale access will be time unlimited. On the basis of the obligations set out under the terms of the grant, the grant recipient must allow - within the wholesale offer - access to the related "non-subsidized" part of the infrastructure, taking into account the principle of proportionality. Access provided based on wholesale offer must be provided by the grant recipient under the same conditions, adequate to the technological solutions in all set up networks using subsidies, without distinction to the character of the area.

Detailed information about the rules of the subsidized NGA network operator's wholesale offer are listed here:

CTO instructions on the wholesale offer: [pokyny_velkoobchodni_nabidka_ctu_11-16.pdf](#)

¹⁶ [EU Guidelines on the use of state subsidies in relation to fast implementation of broadband networks \(2013/C 25/01\)](#) (hereinafter as "EU Guidelines")
[Commission recommendation of 20 September 2010 on regulated access to access networks of new generation \(NGA\)\(2010/572/EU\)](#)

5.2. Method of assessing and ensuring compliance of the offers with this document and dispute resolution

5.2.1. Assessment of compliance of the wholesale offer with the Guidelines

An integral part of the Grant Award Decision will be these guidelines. The grant recipient undertakes to comply with the Guidelines in drafting their wholesale (reference) offers.

No later than six months before the planned launch of the network of the grant recipient, along with the publication of a reference offer, the recipient shall submit this offer to the Grant Provider for assessment along with these Guidelines.

When assessing compliance of the wholesale (referential) offer, the Grant Provider shall, if needed, ask the Czech Telecommunication Office for expertise. In the case of non-compliance of a specific wholesale (referential) offer with these Guidelines, the Grant Provider shall ask the grant recipient to solve the problem urgently. A persistent noncompliance of the wholesale (referential) offer with these Guidelines may be evaluated by the Grant Provider as a violation of the terms under which the grant is provided and may even lead to the removal of subsidies.

5.2.2. Resolution of disputes

Disputes concerning failure to provide access under the terms of wholesale (referential) offers are solved by the Grant Provider. At the request of the Grant Provider, the CTO shall provide expert assessment on the subject of the dispute, as regards the application of conditions and requirements imposed by these Guidelines to the wholesale offer.

The Grant Provider, when resolving the dispute, shall focus on the fulfilment of the defined conditions of the provided grant, i.e. if in the subject of the dispute the access offered or provided under the terms of the wholesale offer as stated in these Guidelines, i.e. in compliance with the Grant Award Decision. In these cases is not a dispute pursuant to the Act on Electronic Communications.

In the event that during the dispute resolution process the Grant Provider concludes that the access is not offered or provided in compliance with the conditions of the provided subvention, including the terms of these Guidelines, the Grant Provider shall ask the grant recipient to remedy the problem immediately. Any non-compliance with the terms of the offered or provided access detected in the course of the dispute resolution may be evaluated by the Grant Provider as a breach of conditions under which the grant was provided and it may lead to grant withdrawal.

End of Part V.

Part VI.

6. Related documents, links to sources, used terms and abbreviations

6.1. Related documents:

- National plan of the Next Generation Networks development – [*hyperlink*](#)
- EC Guidelines 2013/C25/01 [*hyperlink*](#)
- Act no. xyz/2017 Coll. About facilitation of network construction (draft) [*hyperlink*](#)
- Electronic communication act 127/2005 Coll. [*hyperlink*](#)
- CTO methodology of measurement in fixed electronic communication networks [*hyperlink*](#)
- CTO guidelines on wholesale offer at subsidised networks [*hyperlink*](#)
- Assessment of the options to deploy the WIFI technology in the band 5 GHz when realizing the NGA network [*hyperlink*](#)
- Administrative inspection of qualitative parameters in electric communication network [*hyperlink*](#)
- Simplified business plan of the investor and operator of broadband network of electronic communications, setup based on the expected cash flow [*hyperlink*](#)

6.2. Links to sources:

1. ČTÚ, „Stanovení základních parametrů a měření kvality služby přístupu k síti Internet,“ 2014, [Online]. Available: https://www.ctu.cz/cs/download/datovy_provoz/rizeni_datoveho_provozu_stanoveni_za_kladnich_parametru_18_12_2014.pdf.
2. ČTÚ, „měření datových parametrů sítě pomocí TCP protokolu,“ 2014, [Online]. Available: http://www.ctu.cz/cs/download/datovy_provoz/rizeni_datoveho_provozu_metodika_mereni_17_12_2014_v0_4_5.pdf.
3. IETF RFC 2544, „Benchmarking Methodology for Network Interconnect Devices“, 1999, [Online]. Available: <https://tools.ietf.org/html/rfc2544>.
4. ITU-T Y.1564, „Ethernet service activation test methodology“, 2011. [Online].
5. IETF RFC 6349, „Framework for TCP Throughput Testing“, 2011, [Online]. Available: <https://tools.ietf.org/html/rfc6349>.
6. IETF RFC 4898, „TCP Extended Statistics MIB“, 2007, [Online]. Available: <https://tools.ietf.org/html/rfc4898>.

6.3. Terms and abbreviations:

100BASE-TX	Transmission system for Ethernet 100 Mbit/s
1000BASE-T	Transmission system for Ethernet 1 Gbit/s
AON	Active Optical Network
AP	Access Point
ARPU	Average Revenue Per Unit
ASA	Autonomous system
BEREC	Body of European Regulators for Electronic Communications
BER	Bit Error Rate
BERT	Bit Error Rate Test
BGP	Border Gateway Protocol, router protocol
BRAS	Broadband Remote Access Server
BS	Buffer Size
CATV	Community Antenna Television, cable television, a cable network made of optical and coaxial cables providing multimedia services and internet access based on a frequency multiplex.
CDN	Content Delivery Network
CIR	Committed Information Rate – guaranteed minimum network throughput rate
CMTS	Cable modem termination system – a control and communication server in the DOCSIS system for operation of data services in a CATV network
CO	Central Office, a central point of an access network, a central point in the NGA network in which there is an active technology to which all participants in the perimeter of certain NGA network are connected
CoS	Class of Service
CPE	Customer-premises equipment
CWDM	Coarse wavelength-division multiplexing
ČTÚ (CTO)	Český Telekomunikační Úřad, Czech Telecommunication Office
DB	Distribuční Bod (Distribution Point)
DC	Distribution Centre
DDoS	Distributed Denial of Service
DOCSIS	Data Over Cable Service Interface Specification
DSLAM	Digital User Line Access Multiplexer
EK (EC)	Evropská Komise (European Commission)
EMC	Electromagnetic Compatibility
ENNR	European Net Neutrality Rules
EP	European Parliament
EU	European Union
FTTx	Fibre To The x (Home, Building, Cabinet, etc.)
FSO	Free Space Optics
G-fast	modernised VDSL system for user loops shorter than 500 m
GPON	Gigabit Passive Optical Networks, Gigabit network under ITU-T G.98
GPS	Global Positioning System
HDPE	High density polyethylene
HFC	Hybrid Fibre Coax
HS	Head Station, main station
HTTP	Hypertext Transfer Protocol,
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical and Electronics Engineers

IETF	Internet Engineering Task Force
IP	Internet protocol
IPTV	IP based digital television
IRU	Indefeasible Right of Use, long term lease
ISO	International Organization for Standardization
ITU	International Telecommunication Union
LAN	Local Area Network
LTE	Long Term Evolution
MAC	Media Access Control
MB	Megabyte
MDU	Multiplexer Decoder Unit
MEF	Metro Ethernet Forum
MFČR	Ministerstvo Financí ČR (Ministry of Finance)
MIB	Management Information Base
MIMO	Multiple-input multiple-output
MMR	Ministerstvo pro Místní Rozvoj (Ministry of Regional Development)
MoCA	Multimedia over Coax Alliance
MPO	Ministerstvo Průmyslu a Obchodu (Ministry of Industry and Trade)
MTU	Maximum Transmission Unit
NAT	Network Address Translation
NG-PON2	Next Generation Passive Optical Network 2 – a developer standard for passive optical networks (PON)
NGA	New Generation Access
NGN	New Generation Networks
NIX	Neutral Internet Exchange
NNI	Network-to-network interface;
NPRSNG	Národní Plán Rozvoje Sítí Nové Generace (National plan of the Next Generation Network development)
ODF	Optical Distribution Frame
OLT	Optical Line Termination
ONT	Optical Network Terminal
ONU	Optical Network Unit
OPPIK	Operational programme of business and innovation for competitive strength
OSI	Open Systems Interconnection
OTT	Over-The-Top, delivery of audio and video content and other media via internet without involving the internet provider in the content inspection or distribution.
PLR	Packet Loss Rate
P-MP	Point To Multipoint
PON	Passive Optical Network
POP	Point Of the Presence
P – P	Point To Point
PSTN	Public Switched Telephone Network
RFC	Requests For Comments
RFOG	Radio Frequency Over Glass, a system for transmission of high-frequency signals via optical fibre (e.g. for transmission of TV in the form usual in cable TV networks)
RPI	Registr Pasivní Infrastruktury (Register of Passive Infrastructure)
RTT	Round Trip Time
RUIAN	Registr územní identifikace, adres a nemovitostí (Register of territorial identification, addresses and real estates)
RWND	Receiver Window
SC	Street cabinet

S-JTSK	Systém jednotné trigonometrické sítě katastrální (System of unified trigonometric cadastral network)
SLA	Service Level Agreement
SP	Service Provider
TCP	Transmission Control Protocol
TI – NGA	Technical infrastructure of NGA networks
UDP	User Datagram Protocol
UNI	User Network Interface
UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VDSL	Very High Speed DSL
VF	Výměnný Formát (Replaceable Format)
VLAN	Virtual LAN (IEEE 802.1Q), a standard of local network defined under ITU
VN	Vysoké napětí (High Voltage)
VoD	Video on Demand
VPN	virtual private network
VULA	Virtual Unbundled Line Access, virtual access to communication line
VVN	Velmi Vysoké Napětí (Very High Voltage)
WACC	Weighted Average Cost of Capital
WDM	wavelength-division multiplexing
xDSL	x Digital User Line (ADSL, ADSL2, ADSL2+,VDSL, VDSL2, etc.)
ZSJ	Základní Sídelní Jednotka (Elementary Residential Unit)

End of Part VI.