

The Ministry of Transport and Communication of Ukraine
The State Administration of Communication

A.S. Popov Odessa National Academy of Telecommunications

Chair of Communication Networks

Methodical instructions for performance of the course project
Module 4.1: Network services. Network applications

Part 2

DESIGN OF MULTISERVICE NETWORK

**for students of all education forms
on discipline *Telecommunication***

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This guidance is concerned with the theoretical bases of construction of the territorial distributed networks and mechanisms of providing Quality of Service (QoS) in such networks. Technology of ATM is studied, as the basic technology of construction of networks with the guaranteed quality of service. There are concerned the basic types of interfaces, classes of traffic and quantitative indexes of QoS, which distinguish in ATM networks.

The present guidance concerned with the methods of calculations of coefficients of informative gravitation after a few factors of influence. Carried out network synthesis for the commuted topology and the methods of traffic calculations are studied, that is generated by the network objects.

ACCEPTED

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I. Introduction

General characteristics of subjects:

Number of Credits ECTS	– 2
Modules	– 1
Course project	– 1
Total hours	– 72

Including:

– Audience	– 40 hours
– Lectures	– 16 hours
– Practical trainings	– 8 hours
– Laboratory works	– 16 hours
– Student independent work	– 32 hours

Types of control:

- current control knowledge by lectures;
- exam;
- control of complex tasks in practical lessons;
- grade for course project.

II. The purpose of the discipline

Forming the students the basic knowledge necessary for understanding a wide range of issues in telecommunications. Study of general principles of construction and operation mechanisms of modern telecommunications and information networks, methods for solving real problems that may arise during the construction, operation and modernization of existing telecommunications and information networks. Getting skills in real telecommunication and information networks.

III. The content of the discipline

Module 4.1: Network services. Network applications
(2 credits = 72 hours).

Input requirements for the module study (knowledge and skills in disciplines that provide the study of this module).

№	Knowledge contents	Code number
1	2	3
1	Knowledge general to conception of construction and functioning of modern communication networks, constructions of multiservice networks; structure and prospects of development of the internet and global informative infrastructure, general principles and methods of management networks	
	Skills contents	
2	Ability to adjust the TE of information networks; to adjust network protocols. Ability to set up traffics which are generated by users of information networks; to synthesize network structure; to carry out the reasonable choice of network equipment for the network construction	

Module 4.1 structure

№	Contents module	Lectures (hour)	Practical employ-ments (hour)	Lab task (hour)	Indivi-dual works (hour)	Self-instruction (hour)
1	2	3	4	5	6	7
Module 4.1. Network services. Network applications (2 credits = 72 hours)						
1	General concepts and determinations	2		2	4	
2	Network services	2	2	2	7	1
3	Services of network	4	2	4	7	
4	Convergence platforms of granting services	2		2	3,5	1
5	Open access to services	2	2	2	3,5	1
6	Network applications	4	2	4	7	1
	Total hours:	16	8	16	32	4

Themes of practical trainings

№	Theme	Hour
1	2	3
1	Construction of multiservice networks. Calculation of multiservice network traffic.	2
2	Forming a matrix of the mutual gravitation between objects.	2
3	Synthesis of network structure, calculation of information streams.	2
4	Selection of network equipment.	2
	Total:	8

List of laboratory works

№	Theme	Hour
1	2	3
1	Adjustment of dialogue multimedia service.	2
2	The video-conferencing organization.	2
3	Research of the features of language services using RTSP protocol.	2
4	Investigation of the process of service delivery.	2
5	Creation of web-page HTML and adjustment of network service HTTP.	2
6	Web design and Web hosting.	2
7	Creation Internet-hosting services. Installation and adjustment of web server Apache.	2
8	Adjustment of Proxy Server.	2
	Total:	16

Initial knowledge and skills from module 3

№	Knowledge contents	Code number
1	2	3
1	Knowledge of base principles of organization and functioning of the distributed information resources and use in local and global informative networks.	

1	2	3
2	Realization of main conceptions and tendency of development of electronic business-applications trends, development of the newest information technologies, in the field of human activity	
	Skills contents	
3	Ability to use the distributed information resources in the internet, reception of practical skills in the use of modern network, usage in different industries of human activity	

IV. Subjects of course project

Design of multiservice network.

1. Design objective.
2. Basic mark data for the design.
3. Calculation of traffic of network objects and forming a matrix of information gravitation.
4. Synthesis of the network structure and selection of switching equipment.

V. Training methods

Lectures with the help technical means, practical and laboratory researches, term paper performance, the usage of methodical maintenance of discipline and an electronic database of the department.

VI. Estimation methods

- Current control knowledge lectures;
- exam;
- control of making individual tasks at practical lessons;
- defence the protocols of laboratory works;
- defence the term paper.

Estimation is conducted according to the ESNS scale, national scale and ONAT (100 points) scale.

VII. Literature

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GENERAL POSITIONS

Multiservice networks provide the widest spectrum of qualitative services for consumers by means of effective usage of transmission network resources and universal method of load processing that is created by different applications. The main transport technology of the multiservice networks is the ATM technology (Asynchronous Transfer Mode) [1].

Primarily ATM as standardized architecture with batch-oriented transmission and switching was intended for broadband digital networks' maintenance with service integration (B-ISDN). Since then the capabilities of ATM have been extended to support the different types of services such as broadband, narrowband, flutter traffic, real-time applications.

Batch switching is based on Virtual Channel Identifier (VCI) that appointed during the connection and deleted after the connection. The address of ATM end node, on the base of which the Virtual Channel is laid, has hierarchy structure similar to the number of telephone network and it also uses the prefixes, the countries corresponding codes, cities, network of service providers peculiarity simplifies the routing of connection request.

The Virtual Circuit can be Permanent (PVC) and Switched (SVC). To accelerate the switching into the large networks is used Virtual Path that interconnects the Virtual Channels that have common path between initial and end points in ATM network or common part of the path between some network switches. Virtual Path Identifier (VPI) is the highest part of the local address. It is the common prefix used by several different Virtual Channels. Thus, in ATM technology the idea of address aggregation is used in two levels that are the level of terminal nodes addresses (it works during the Virtual Channel established) and the level of Virtual Channels numbers (it works during the data is transmission over established Virtual Channel).

For each type of services ATM provides the defined quality of load services that are estimated by the following parameters such as packets delay, dispersion of delay and probability of packets loss. This option is called the Quality of

Service (QoS). QoS realization is the main feature that distinguishes ATM technology from other technologies. It allows to provide the full transmission of integrated traffic (voice, video, data). In this cast total heterogeneous traffic is transformed into standard cells which consist of 48-byte packets and 5-byte headings.

With respect to the sources requirements of the bit rate and QoS there are distinguished the following categories of traffic:

- with Constant Bit Rate (CBR);
- with Variable Bit Rate (VBR);
- with Available Bit Rate (ABR);
- with Unspecified Bit Rate (UBR).

The main network devices of ATM are ATM-switches, with the help of which the virtual connection is provided during the communication session and is supplied to the QoS users. [1]

In ATM networks there are two types of interfaces such as User-Network Interface (UNI) and Network-Node Interface (NNI). The interfaces UNI provides the connection of peripheral device (for example, router), which does not refer to the ATM network, to ATM switcher of basic network. UNI specification identifies packet structure, station labelling, exchange of control information, ATM protocol levels, methods of Virtual Channel establishment and methods of traffic control. The interface NNI is used for interconnection between ATM switches.

The ATM standard does not introduce its own specifications of physical layer realization. Here it is based on SDH/SONET technology using its rate hierarchy. According to this notion the initial access speed that is able of being used by the user of the network is the bit rate of STM-1 that corresponds to 155 Mbit/s. The ATM backbone equipment operates on higher bit rates such as STM-4 (622 Mbit/s) and STM-16 (2.5 Gbit/s). At the bitrate of 155Mbit/s it is possible to use not only fiber optic cable, but it is also possible to use unshielded twisted pair of category 5. At the bitrate of 622 Mbit/s only fiber optic cable is

acceptable. The operation on superhigh rates essentially increases the price of ATM equipment because of realization complexity of packets partitioning into cells and cells assembling into packets in user interface switches.

ATM networks also have other physical interfaces that differ from SDH/SONET. There are interfaces such as T1/E1 and T3/E3, which are widely used in global network, and interfaces of local networks that can be interface having 4B/5B coding with bitrate of 100 Mbit/s (FDDI) and interface with bitrate of 25 Mbit/s, which was introduced by IBM and approved by ATM Forum. In addition, for the bitrate of 155,52 Mbit/s the physical layer is defined that called «cell-based». This layer is based on the cells. It does not use frames of SDH/SONET, it transmits the ATM cells trough the communication channel. In such way the overhead delivery caused by service data decreases, but it is more difficult to synchronize transmitter with receiver on the cell level.

ATM networks are created according to the principle of switched media (switched topology) with separation of access level, levels of distribution and core (see Figure 1). In terrestrial networks the access level represents basic network that connects ATM switches that located in the regional switching nodes. The distribution level identifies the zonal nodes that contain ATM-switches. Switches of core level are placed in the main terrestrial nodes.

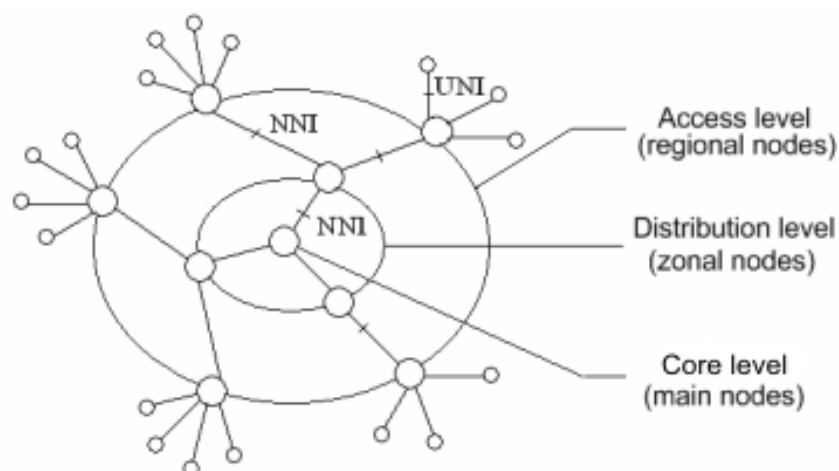


Figure 1 – Switching topology

Service class is the qualitative characteristics of defined services provided data transmission through the ATM networks. If the application indicates that transmission of voice traffic is demanded, that is why in this case the most important quality factors for customers will be delays and Cell-Delay Variations (CVD) that have the biggest influence on quality of data transmission such as voice or pictures. Moreover the loss of separate cell with several samples is not so important, because the device reproducing voice can approximate missed samples, that is why the quality of data transmission does not suffer very much. Synchronization requirements of data transmission became very important for many applications that correspond not only to voice, but also to video. That is the reason why these requirements are the first criterion according to which the traffic is divided into classes.

There were defined 5 classes that are distinguished by the following qualitative characteristics:

- of presence or absence of bitrates that can be variable bit rate (VBR) or constant bit rate (CBR);
- of synchronization requirements of data transmission between transmitting and receiving parties;
- of protocol type that transmits its data through the ATM network that can be with connection establishment or without connection establishment (only for computer data transmission).

The main characteristics of ATM traffic classes are shown in the Table 1.

It is obviously that using only qualitative characteristics defined by class of traffic is not enough to describe the required services. In ATM technology for each class of traffic the set of quantitative parameters is defined, which have to be known by application. For example, for traffic of class A it is necessary to indicate constant bitrate, which will be used by application to transmit data via the network. For traffic of class B it is necessary to indicate maximum bitrate, average bitrate and maximum burst size. For the voice traffic not only synchronization between

transmitting and receiving parties is used, but the upper limit of delay and Cell-Delay Variation are also quantitatively pointed.

Table 1 – Classes of ATM traffic

Classes of traffic	Characteristic
<i>A</i>	Constant Bit Rate (CBR).
	Synchronization requirements of data transmission between transmitting and receiving parties are used.
	With connection establishment.
	Example: voice traffic, video traffic.
<i>B</i>	Variable Bit Rate (VBR).
	Synchronization requirements of data transmission between transmitting and receiving parties are used.
	With connection establishment.
	Example: compressing voice, compressing video.
<i>C</i>	Variable Bit Rate (VBR).
	Synchronization requirements of data transmission between transmitting and receiving parties are not used.
	With connection establishment.
	Example: traffic of computer networks where the terminal nodes use protocol with connection establishment such as frame relay, X.25, TCP.
<i>D</i>	Variable Bit Rate (VBR).
	Synchronization requirements of data transmission between transmitting and receiving part are not used.
	Without connection establishment.
	Example: traffic of computer networks where the terminal nodes use protocol without connection establishment such as IP, Ethernet, SNMP.
<i>X</i>	Type of traffic and its parameters are identified by the user.

In ATM technology the following set of main parameters is supported:

- Peak Cell Rate (PCR);
- Sustained Cell Rate (SCR);
- Minimum Cell Rate (MCR);
- Maximum Burst Size (MBS);
- Cell Loss Ratio (CLR);

- Cell Transfer Delay (CTD);
- Cell Delay Variation (CDV).

The parameters of bitrates are measured in cells per second, the maximum burst size is measured in cells and the timing performances are measured in seconds. Maximum Burst Size defines the number of cells that can be transmitted by application with the maximum bitrates PCR if the average bitrates are given. Cell Loss Ratio is the ration of lost cells to the total number of transmitted cells through the defined virtual connection. Since the virtual connection is duplex, then for each direction can be given different values of parameters.

The agreement between application and ATM network is called the traffic-contract. Its main difference from agreement used by frame relay networks is the choice of one traffic class, for which besides parameters of traffic throughput parameters of cells delay and parameters of cell transmission reliability are also mentioned [2].

1. Design objective

The **purpose** of the course project is to organize a platform and to provide a specified list of services (including broadband) and the definition of their quality. The Goal is achieved solving the following **design objectives**:

1. Calculation of traffic generated by users of the network objects and forming a matrix of the mutual gravitation between objects.
2. Synthesis of network structure and formation of the connection matrix .
3. Selection of switching equipment of nodes (ATM switches) and the formation of the requirements for transmission systems equipment of communication lines to provide the necessary bandwidth.

2. Basic data for the design

2.1. The scale of the territory covered by the network is determined by the boundaries of Ukraine. The administrative regions of Ukraine are taken as the objects of the network, the total number of which is $n = 25$ (map of Ukraine is given in *Appendix A*). The resulting load of the network object is concentrated in the regional centre. Regional centres are considered as the location of the access layer nodes in a multi-service network.

2.2. As the potential users of each network object it is considered population of Ukrainian regions (see **Table 2**).

2.3. List of broadband providing services with an indication of users class (PS – Privet Sector, BS- Business Sector, PBX - Private Branch Exchange, SC - Service Centre) and traffic parameters are given in **Table 3**.

2.4. Structural composition of users network object , is given in *Appendix B* (variant is chosen according to the serial number of students in a class register).

2.5. Distance matrix $\mathbf{R} = ||r_{ij}||$ with size (25x25) where r_{ij} defines the distance between nodes i and j via primary network cable is given in **Table 5**.

NOTE:

The number of network zones and the name of zonal nodes selected from Table 4 according to the given variant (variant selected by the penultimate digit of student card). In accordance with the considered switching topology of designed network (Figure 1) at the access layer the regional nodes are used.

While determining the number of users for each service in a network objects should be taken into account that at any moment of time in the network simultaneously works only w (%) of the total number of users. Percentage of simultaneously working users in the network is chosen by variant from **Table 4** (variant number corresponds to the last digit of student card).

Table 2 – Population of Ukrainian regions

Number of network object	Name of Ukrainian regions	Number of potential users, thous. pers.
1	Vinnytsya oblast	1641,2
2	Dnepropetrovsk oblast	3336,5
3	Donetsk oblast oblast	4433
4	Zhitomir oblast	1279
5	Zaporozhye oblast	1801,3
6	Ivano-Frankovsk oblast	1379,8
7	Kiev oblast	4516,8
8	Kirovograd oblast	1010
9	Lugansk oblast	2291,3
10	Volyn oblast (Lutsk)	1037,2
11	Lvov oblast	2544,7
12	Nikolaev oblast	1183,3
13	Odessa oblast	2388,7
14	Poltava oblast	1487,8
15	Rovno oblast	1152,5
16	AR of Crimea (Simferopol)	2344,3
17	Sumy oblast	1161,5
18	Ternopol oblast	1084,1
19	Zakarpattia oblast (Uzhgorod)	1247,4
20	Kharkov oblast	2755,1
21	Kherson oblast	1088,2
22	Khmelnitskiy oblast	1326,9
23	Cherkassy oblast	1285,4
24	Chernovtsy oblast	904,3
25	Chernigov oblast	1098,2

Table 3 – List of services with indication of user classes

Service k	User class q_k	Peak rate B_p^k , bit/s	Burstness $burst(q_k)$	Peak or session duration		Number of call during busy hours $W_{q_k}^{(k)}$
				$T_{P, s}$	$T_{C, s}$	
1 Telephony	PS	64K	1	100	100	3,6
	BS	64K	1	100	100	14,4
	PBX	64K	1	160	160	162,0
2 Fax (colour)	PS	2M	1	3	3	12,0
	PBX	2M	1	7	7	18,0
3 Video Telephony	PS	10M	5	20	100	0,72
	BS	10M	5	20	100	1,56
	PBX	10M	5	40	200	3,60
4 Video Search	PS	10M	18	10	180	0,2
	BS	10M	18	10	180	2,0
	PBX	10M	22	15	330	8,0
	SC	10M	22	15	330	46,2
5 Documents Search	PS	64K	200	1,5	300	0,6
	BS	64K	200	1,5	300	3,0
	PBX	64K	250	2	500	6,0
	SC	64K	250	2	500	39,6
6 Data Transmission	PS	64K	400	0,075	30	24,0
	PBX	64K	400	0,075	30	72,0

Table 4 – Names of zonal units and the percentage of simultaneously working users

Last digit of student card	$W, \%$	Penultimate digit of student card	Number of zones, m	Zone centres J_p
1	3	1	7	Kiev, Lviv, Chernivtsi, Zhytomyr, Sumy, Luhansk, Odessa
2	4	2	5	Kiev, Kherson, Donetsk, Lviv, Vinnytsia
3	4	3	5	Lviv, Kiev, Poltava, Zaporizhzhia, Simferopol
4	7	4	6	Ternopil, Kiev, Poltava, Mykolaiv, Donetsk, Uzhhorod
5	5	5	7	Kiev, Uzhhorod, Khmelnytskyi, Cherkasy, Odesa, Donetsk, Kharkiv
6	4	6	6	Kiev, Luhansk, Simferopol, Chernihiv, Khmelnytskyi, Lviv
7	3	7	4	Lviv, Kiev, Odessa, Luhansk
8	5	8	7	Kiev, Ternopil, Cherkasy, Donetsk, Khmelnytskyi, Kherson, Zaporizhzhia
9	3	9	7	Kiev, Lutsk, Chernihiv, Simferopol, Luhansk, Chernivtsi, Kharkiv
0	6	0	6	Kiev, Lutsk, Khmelnytskyi, Sumy, Odessa, Donetsk

Table 5 – Distance matrix between regional centres of Ukraine (in km)

Regional centres	Vinnytsya	Dnepropetrovsk	Donetsk	Zhitomir	Zaporozhye	Ivano-Frankovsk	Kiev	Kirovograd	Lugansk	Lutsk	Lvov	Nikolaev	Odessa	Poltava	Rovno	Simferopol	Sumy	Ternopol	Uzhgorod	Kharkov	Kherson	Khmelnitskiy	Cherkassy	Chernovtsy	Chernigov	
Number of network object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Vinnytsya	1		571	812	126	637	373	266	317	972	387	369	466	429	579	313	801	611	239	593	720	533	122	340	312	423
Dnepropetrovsk	2	571		250	630	89	952	479	246	401	888	948	329	463	183	814	458	366	818	1172	222	316	701	326	891	585
Donetsk	3	812	250		880	254	1202	729	496	151	1138	1198	579	713	391	1064	571	488	1068	1422	283	535	951	576	1141	826
Zhitomir	4	126	630	880		719	459	140	434	987	261	407	592	555	494	187	927	485	325	679	638	659	208	352	398	297
Zaporozhye	5	637	89	254	719		1018	568	314	394	977	1014	352	486	277	903	371	460	884	1238	303	292	767	415	957	674
Ivano-Frankovsk	6	373	952	1202	459	1018		599	698	1352	273	135	785	658	953	292	1124	944	137	301	1097	856	251	721	143	756
Kiev	7	266	479	729	140	568	599		299	836	398	544	517	480	343	324	852	339	465	819	487	584	348	201	538	151
Kirovograd	8	317	246	496	434	314	689	299		647	692	694	180	337	251	618	524	434	564	918	395	251	447	126	637	436
Lugansk	9	972	401	151	987	394	1352	836	647		1245	1349	730	864	493	1171	722	535	1219	1573	303	686	1102	727	1192	873
Lutsk	10	387	888	1138	261	977	273	398	692	1245		152	853	816	752	70	1188	743	163	432	896	920	268	610	336	555
Lvov	11	369	948	1198	407	1014	135	544	694	1349	152		843	743	898	215	1178	889	127	278	1042	910	247	717	278	701
Nikolaev	12	466	329	579	592	352	785	517	180	730	853	843		134	488	779	339	671	713	1067	551	71	596	368	642	671
Odessa	13	429	463	713	555	486	658	480	337	864	816	743	134		596	742	473	779	676	959	685	205	559	453	515	634
Poltava	14	576	183	391	494	277	953	343	251	493	752	898	488	596		678	631	183	819	1173	144	499	702	271	892	412
Rovno	15	313	814	1064	187	903	292	324	618	1171	70	215	779	742	678		1114	669	158	495	823	846	192	536	331	481
Simferopol	16	801	458	571	927	371	1124	852	524	722	1188	1178	339	473	631	1114		814	1048	1402	657	279	931	649	981	959
Sumy	17	611	366	488	485	460	944	339	434	535	743	889	671	779	183	669	814		810	1164	185	682	693	343	883	338
Ternopol	18	239	818	1068	325	884	137	465	564	1219	163	127	713	676	819	158	1048	810		353	963	780	117	587	176	622
Uzhgorod	19	593	1172	1422	679	1238	301	819	918	1573	432	278	1067	959	1173	495	1402	1164	353		1317	1134	471	941	444	976
Kharkov	20	720	222	283	638	303	1097	487	395	303	896	1042	551	685	144	823	657	185	963	1317		538	846	415	1036	523
Kherson	21	533	316	535	659	292	856	584	251	686	920	910	71	205	499	846	279	682	780	1134	538		663	411	713	738
Khmelnitskiy	22	122	701	951	208	767	251	348	447	1102	268	247	596	559	702	192	931	693	117	471	846	663		470	190	505
Cherkassy	23	340	326	576	352	415	721	201	126	727	610	717	368	453	271	536	649	343	587	941	415	411	470		660	311
Chernovtsy	24	312	891	1141	398	957	143	538	637	1192	336	278	642	515	892	331	981	883	176	444	1036	713	190	660		695
Chernigov	25	423	585	826	297	674	756	151	436	873	555	701	671	634	412	481	959	338	622	976	523	738	505	311	695	

3. Calculation of traffic generated by the users of network objects

The intensity of traffic (bits/sec) generated by users of i -th object is defined as the total stream of information coming into the regional switching node from all six services during the busy hours (BH):

$$\gamma_i^\Sigma = \sum_{k=1}^K \gamma_i^k, \quad i = 1, 2, \dots, 25, \quad (1)$$

where k – row number of corresponding service in the **Table 1**; K – total number of this services; γ_i^k - intensity matrix of traffic during BH on i -th object and k -th service:

$$\gamma_i^k = B^k \psi_i^k, \quad (2)$$

where B^k - peak rate B_p^k for traffic of CBR category (Constant Bit Rate) or average bitrate B_m^k for traffic of VBR category (Variable Bit Rate) and ABR (Available Bit Rate) in bit/sec. Value of B_p^k is taken from **Table 3** directly, value of B_m^k is calculated by formula:

$$B_m^k = \frac{B_p^k}{burst(q_k)}, \quad (3)$$

where $burst(q_k)$ – burstness.

To CBR relates traffic for which $T_p = T_c$, i.e. peak duration is equal to the duration of session (see in **Table 3**).

Dimensionless value ψ_i^k in formula (2) means specific average by user classes inside each k -th service and reduced to one-second activity of k -th service of i -th object (region) during BH; it is calculated by formula:

$$\psi_i^k = \frac{\sum_{q_k} N_{q_k}^i W_{q_k}^i T_{q_k}^i}{\tau}, \quad (4)$$

where in formula (4):

q_k – users class each of k -th service in accordance with **Table 3**, for example, service number 1 (telephony) has three classes: PS – privet sector, BS – business sector, PBX;

$N_{q_k}^i$ – number of simultaneously working users in the network of q_k class in k -th service on the i -th object; determined in accordance with to the total number of users of corresponding objects and services, as well as conditionally defined percentage of their total number (in accordance with **Table 4**);

$W_{q_k}^i$ – calls number during BH of q_k class in k -th service on the i -th object;

$T_{q_k}^i$ – average duration of session of q_k class user in k -th service on the i -th object (in sec);

τ – number of seconds in one hour (in sec).

The total load is divided into two components: one, is locked inside the zone $\gamma_{lock}(i)$ (internal) and second – external load $\gamma_{ext}(i)$, outgoing to another zones. Their relationship is defined on the basis of empirical evidence, for example, 80% + 20%. Thus, the external traffic generated by each object during BH is:

$$\gamma_{ext}(i) = 0,2 \cdot \gamma_i^{\Sigma} \quad (5)$$

And the internal traffic generated by each object during BH is:

$$\gamma_{lock}(i) = 0,8 \cdot \gamma_i^{\Sigma} \quad (6)$$

4. Forming a matrix of information gravitation

Matrix of information gravitation $\gamma(i, j)$ between network nodes specifies the information stream between each pair of nodes in the forward and reverse direction. In general, the elements of this matrix are symmetrical about the main diagonal, i.e. forward and reverse streams may not match with the intensity. Calculation of matrix of informational gravitation in this project is based on a joint account of the two influence factors – information gravitation on distance and load.

Each of these factors is formalized by means of appropriate coefficients of information gravitation by load $K^{(\gamma)}$ and by distance $K^{(R)}$, and their combined effect is determined by the coefficient $K^{(\Sigma)}$. Method for calculating of these coefficients is given below.

Coefficients matrix of information gravitation by load:

$$K^{(\gamma)}(i, j) = \frac{\gamma_j}{G - \gamma_i}, \quad (7)$$

где $G = \sum_{i=1}^{25} \gamma_i$ – total external traffic in all regions.

Conditions of value normalization $K^{(\gamma)}(i, j)$ chosen in a way to fulfill the requirements:

$$\sum_{\substack{j \\ i \neq j}} K^{(\gamma)}(i, j) = 1. \quad (8)$$

Information gravitation by distance is determined empirically according to the principle «The farther objects are from each other, the less expected stream of information between them». Of course, this is only one of possible approximate estimation of influence factors.

Let $r(i, j) = \frac{R(i, j)}{\sum_{\substack{j \\ i \neq j}} R(i, j)}$ – relative distance between i -th and j -th objects

(regional communication nodes). Then coefficients matrix of information gravitation by distance can be defined as the inverse of value:

$$K^{(R)}(i, j) = \frac{\alpha_i}{r(i, j)}, \quad (9)$$

where α_i - normalization coefficient, on condition that:

$$\sum_{\substack{j \\ i \neq j}} K^{(R)}(i, j) = 1, \text{ then } \alpha_i = \left[\sum_j \left(\frac{1}{r(i, j)} \right) \right]^{-1}. \quad (10)$$

Combined calculation of two factors of influence is defined as:

$$K^{(\Sigma)}(i, j) = \beta_i \sqrt{K^{(\gamma)}(i, j) \cdot K^{(R)}(i, j)}, \quad (11)$$

where $\beta_i = \left[\sum_j \sqrt{K^{(\gamma)}(i, j) \cdot K^{(R)}(i, j)} \right]^{-1}$ – normalization coefficient,

chosen on condition that $\sum_{\substack{j \\ i \neq j}} K^{(\Sigma)}(i, j) = 1$.

Knowing the coefficients of information gravitation between objects, matrix of information gravitation between the objects of the network can be formed:

$$\gamma(i, j) = K^{(\Sigma)}(i, j) \cdot \gamma_{ext}(i). \quad (12)$$

In this matrix at the position of the diagonal elements should be written the value of traffic, locked inside of the network object:

$$\gamma(i, i) = \gamma_{lock}(i). \quad (13)$$

5. Synthesis of network structure and formation of the connection matrix

Network structure synthesized on the principle of a switched topology, is a radial-node. Such structure is called hierarchical «star», because it contains several hierarchically ordered levels nodes-connection. Typically, hierarchy of nodes are formed of territorial networks: local, regional, zonal, main nodes.

The nodes of the lowest level of the hierarchy determine the access level, and the highest – core level of the network. Nodes intermediate hierarchical levels form sublevels of distribution level.

Radial communication connecting nodes of different levels are called *backbone*. In cases of economic feasibility in the synthesized network structure may be introduced links connecting nodes of one level of hierarchy. These links are called *transverse*. Criteria for the economic practicality of introducing cross-links tend to reflect allowable load lines, which for each level of the hierarchy of nodes may be different.

In this course project is expected to do the synthesis of the structure of the ATM network, which includes three levels of the nodes hierarchy:

- regional nodes - *access* level;
- zonal nodes - *distribution* level;
- main node - *core* level.

The structure of the synthesized network reflects of the connection matrix $C = \| c_{ij} \|$ (matrix of weights edges of the network). The value of the element c_{ij} is determined by the nearest value of the module STM- n , exceeding the download connection (γ_{ij} or γ_{ji}).

5.1. Formation of zonal network

Regional commutation nodes are divided into specified variant number of zones. Fixing i -th regional node for the j -th zonal center is the criterion:

$$\max_j \left(\frac{\gamma(i, j)}{R(i, j)} \right), \quad (14)$$

where $\gamma(i, j)$ – element of matrix of information gravitation between the pair corresponding nodes.

$R(i, j)$ – element of distances matrix between the regional centers of Ukraine (Table 4).

The regional nodes of each zone are connected by radial communication with its zonal node (see Figure 2).

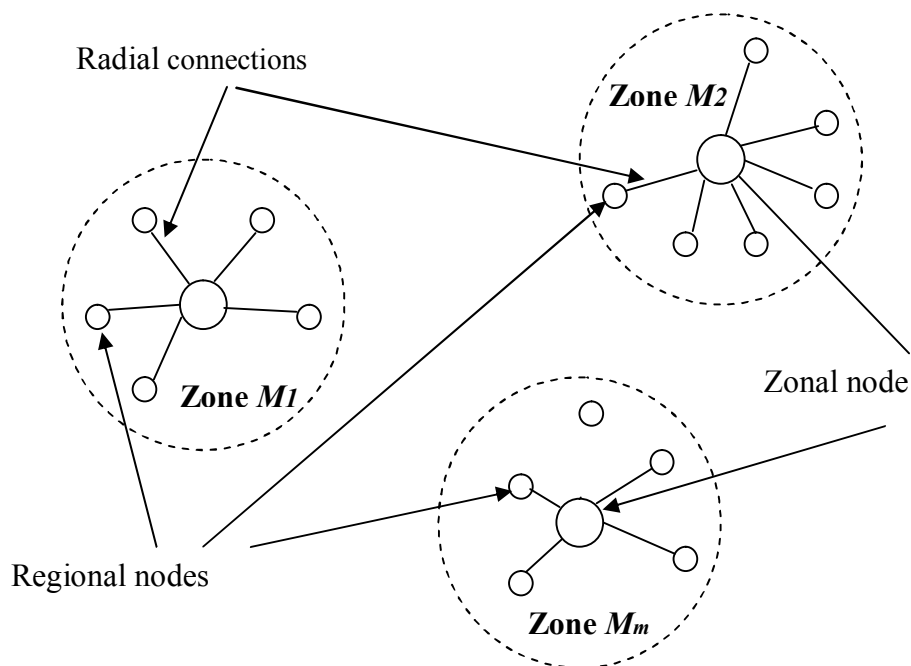


Figure 2 – Formation of zonal network

After that the formation of zonal network is completed, goes the synthesis of the backbone network. To do this, each node connects zonal radial communication with the central node, located in Kiev. (see Figure 3).

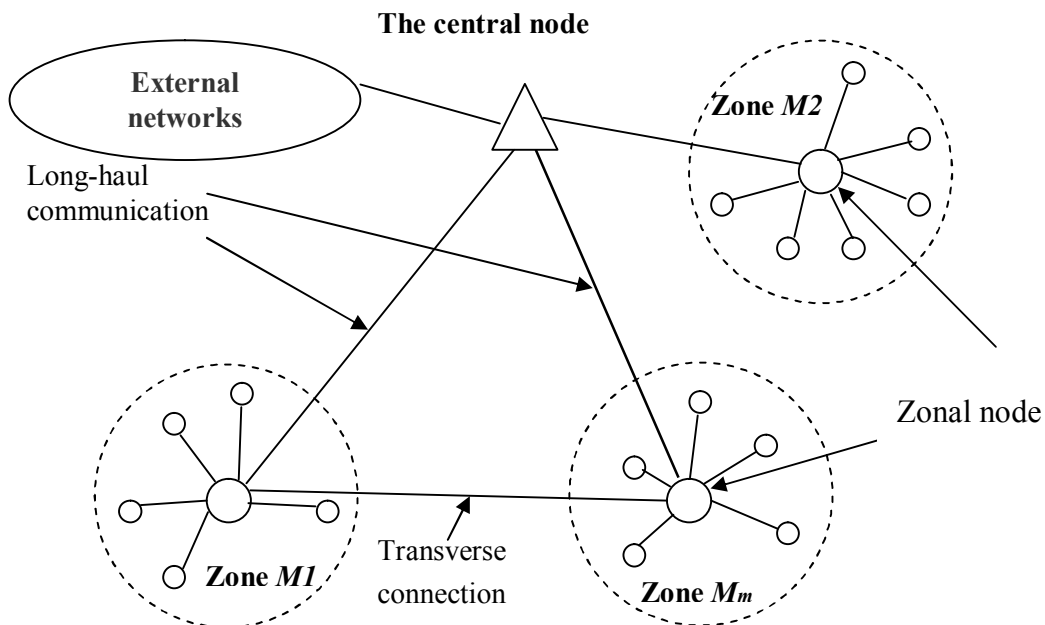


Figure 3 – Formation of backbone network

5.2. Formation of connection matrix

Formation of connection matrix is made on the basis of the matrix of information gravitation $\gamma (i, j)$ (obtained in paragraph 4) in three stages:

1) the connection of regional nodes with their zonal node J_p necessary to fix the connection matrix C . To do this required to determine the value streams for loading the appropriate connection in forward and reverse directions. In the forward direction – this is accordingly the total external stream from node i packet stream, i.e.

$$\gamma_i J_p = \gamma_{iext} \quad (15)$$

where J_p - element of the zones set $M (p = \overline{1, m})$.

Reverse stream direction, internal from the zonal node J_p to the regional node i is determined by the total stream of packets from nodes other zones of the network and is the sum of elements of the i -th column of the matrix of information gravitation:

$$\gamma_{J_p i} = \sum_{i=1}^n \gamma_{ij}$$

2) The value of stream on the backbone (connecting the zonal node J_p and central switching node S) is also recorded in the connection matrix C and is determined by two components: forward and reverse streams. Each of the component is calculated separately.

For each zone $p (p=1\dots m, \forall p \in M)$ defined a set of objects L , which determines the number of nodes in the zone.

Forward stream is defined as the sum of external streams of all nodes in the zone (including the zonal node), excluding those streams that are locked inside the zone.

$$\gamma_{J_p S} = P_{ext} - P_{lock}$$

$$P_{ext} = \sum_{L_p} \gamma_{ext}$$

$$P_{lock} = \sum_{L_p} \sum_{j=1}^n \gamma_{ij}, \forall j \in p$$

Reverse stream is defined as the sum of incoming streams to all nodes of the zone (including the zonal node), excluding the streams generated by the nodes of the zone with each other.

$$\gamma_{SJ_p} = P_{incom} - P_{internal}$$

$$P_{incom} = \sum_{L_p} \sum_{i=1}^n \gamma_{ij}$$

$$P_{internal} = \sum_{L_p} \sum_i \gamma_{ij}, \forall i \in p$$

As on the zonal level (between the regional node and the zonal node) as on the backbone level (between the zonal node and the main node) of two streams (forward and reverse) selects the maximum.

6. Reducing the load on the central node

The central node - the most vulnerable spot network, because at failure of the switch core level (if it does not provide redundancy) network becomes inoperative. Therefore, in order to discharge the central network switch, it is necessary to consider the establishment of cross-links at the distribution level. This information formed the matrix of information gravitation between all the zones network C^{zon} sizes $m \cdot m$, where m - number of zones in the network.

Cross-link is introduced between zones, between which there is a maximum information stream, etc.

$$\max_{\gamma} C^{zon}$$

This stream will be directly between the two zones, bypassing the central node. These changes must be recorded in the connection matrix C , i.e. to carry out re-calculation of streams, which connected of corresponding zonal nodes J_p and the central switching node S .

7. Exchange of information with external networks

All our calculation was carried out exclusively for the streams that are locked within a synthetic network. Therefore, in addition, that was described above, there should be exchange of information with external networks. Point of traffic exchange with external networks is located at the central node. So, for the account of this exchange should increase the load on vertical linkages of the connection matrix C by an appropriate amount. We assume that the external network accounting for 3% of the stream of information, which is generated at each object network.

8. Selection of switching equipment

Based on the recommended list of equipment contained in *Appendix C*, should carry out a selection of ATM switches, serving network. Selection the type of switch and the definition of the type of its modules is performed depending on its location in the network. Similarly, the hierarchy of network identifies three types of switches:

- Access Switches;
- Distribution Switches;
- Core Switches.

Access switches may have a relatively low-bandwidth internal bus, sufficient only for passing the stream of enternal (or external) from the regional node of the network. However, they need to provide support for other technologies that can be used as access networks to the ATM network.

Distribution Switches are increased requirements in terms of bandwidth switch, because their main task – the concentration of streams from multiple nodes, into a single high-speed stream.

Core Switches – is the most high-performance network switching high streams. Since the failure of the central switchboard disrupted their network, as well as its ability to access external network, it is necessary to provide redundancy modules of the switch.

9. List of tables and calculations that should be given in the explanatory note

Basic data:

Table 1 – Structural composition of users network object.

Table 2 – Population of Ukrainian regions.

Table 3 – List of services with indication of users classes.

Table 4 – Names of zonal units and the percentage of simultaneously working users.

Table 5 – Distance matrix between regional centres of Ukraine (in km).

Calculations data:

Table 6 – Distribution users by services.

Table 7 – Number of simultaneously working users in the network.

Table 8 – Number of simultaneously working users in the network with account conversion PBX and SC.

Table 9 – The intensity of traffic generated by each network object.

Table 10 – Coefficients matrix of information gravitation by load.

Table 11 – The matrix of relative distances between network object.

Table 12 – Normalization coefficients α_i .

Table 13 – Coefficients matrix of information gravitation by distance.

Table 14 – Normalization coefficients β_i .

Table 15 – The matrix of the total coefficients of information gravitation.

Table 16 – The matrix of information gravitation between the objects of the network.

Table 17 – Distribution regional nodes to zonal.

Table 18 – The matrix of connection (before the introduction of cross-links).

Table 19 – The matrix of information gravitation between the zones network.

Table 20 – The matrix of connection (after the introduction of cross-links and streams to the external network).

Table 21 – Number and type of the selected equipment.

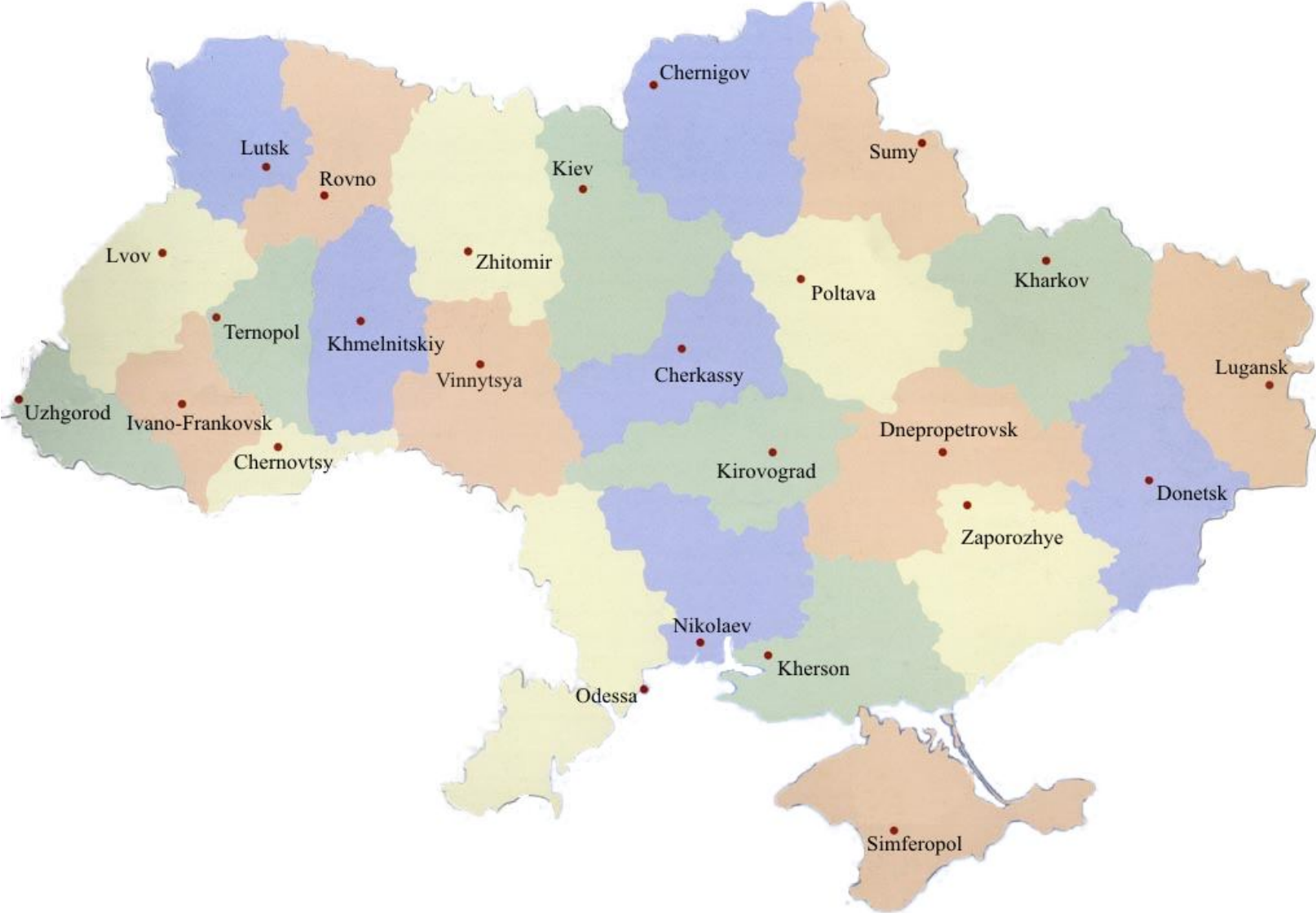
Figure 1 – Map of Ukraine built the network.

Also in the explanatory note should be given a full account of all the variables used in the course project, for a network object.

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Map of Ukraine



*Appendix B*Variant 1

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	26	26	29	25	27	25	27	27	27	30	30	28	27	28	26	29	26	25	27	29	30	28	28	28	28
PS (%)	26	20	38	22	40	33	30	34	30	23	40	22	38	31	26	28	23	36	30	32	26	38	32	33	27
BS (%)	62	62	46	68	47	51	59	53	58	65	44	64	51	50	55	58	58	52	60	55	60	46	58	57	54
PBX (%)	12	18	16	10	13	16	11	13	12	12	16	14	11	19	19	14	19	12	10	13	14	16	10	10	19
Fax color (all %)	3	1	2	1	5	5	3	4	5	1	1	3	1	4	5	4	4	4	1	3	4	5	5	3	5
BS (%)	61	65	70	70	63	60	57	66	67	57	62	64	58	55	70	64	66	56	63	65	60	59	58	69	57
PBX (%)	39	35	30	30	37	40	43	34	33	43	38	36	42	45	30	36	34	44	37	35	40	41	42	31	43
Videotelephony (all %)	10	6	4	7	7	8	10	8	3	8	5	8	8	7	9	6	1	5	2	4	3	2	3	10	4
PS (%)	28	38	31	31	25	37	31	34	30	23	40	24	21	37	36	21	21	39	39	27	28	27	30	40	22
BS (%)	57	46	56	50	60	48	59	52	51	60	49	63	62	50	48	62	61	48	47	60	59	56	54	47	66
PBX (%)	15	16	13	19	15	15	10	14	19	17	11	13	17	13	16	17	18	13	14	13	13	17	16	13	12
Search video (all %)	16	20	20	18	15	20	20	19	17	15	16	16	20	19	15	15	20	20	16	16	16	16	19	20	20
PS (%)	2	7	1	6	5	10	3	8	7	1	5	9	7	2	5	9	7	1	3	7	5	8	1	4	2
BS (%)	49	38	50	44	46	45	46	52	51	40	39	45	35	53	54	48	48	45	47	39	49	48	57	51	49
PBX (%)	27	32	26	35	27	29	31	25	26	35	35	26	34	30	26	25	30	34	26	34	25	25	26	30	29
SC (%)	22	23	23	15	22	16	20	15	16	24	21	20	24	15	15	18	15	20	24	20	21	19	16	15	20
Documents Search (all %)	17	17	15	16	17	19	17	20	16	19	19	17	15	19	15	20	19	19	15	16	16	17	15	17	18
PS (%)	6	7	6	5	6	2	6	9	5	6	4	2	3	8	1	4	9	9	7	4	4	9	1	3	8
BS (%)	40	41	40	42	39	44	37	34	47	45	44	46	53	47	39	46	37	47	44	46	41	33	48	43	44
PBX (%)	35	33	30	29	33	33	33	35	30	33	35	28	25	30	35	30	30	27	34	31	34	33	31	31	25
SC (%)	19	19	24	24	22	21	24	22	18	16	17	24	19	15	25	20	24	17	15	19	21	25	20	23	23
Data transmission (all %)	28	30	30	33	29	23	23	22	32	27	29	28	29	23	30	26	30	27	39	32	31	32	30	22	25
BS (%)	61	61	56	59	65	55	56	66	62	59	67	67	70	57	56	62	56	65	70	67	67	67	63	66	57
PBX (%)	39	39	44	41	35	45	44	34	38	41	33	33	30	43	44	38	44	35	30	33	33	33	37	34	43

Variant 2

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	28	26	30	30	28	30	26	30	26	26	27	30	30	29	28	29	27	30	27	27	29	25	26	30
PS (%)	38	31	32	25	36	28	28	20	30	22	21	34	22	34	33	24	33	23	21	32	20	30	28	38	25
BS (%)	44	49	51	63	45	54	60	65	52	64	63	50	62	46	48	60	54	64	59	54	61	53	52	51	62
PBX (%)	18	20	17	12	19	18	12	15	18	14	16	16	16	20	19	16	13	13	20	14	19	17	20	11	13
Fax color (all %)	4	5	4	4	4	2	3	4	1	1	4	2	1	2	1	1	1	4	1	2	4	4	2	5	4
BS (%)	64	55	59	55	55	55	67	55	63	56	61	57	58	59	56	62	55	65	70	68	70	56	70	60	55
PBX (%)	36	45	41	45	45	45	33	45	37	44	39	43	42	41	44	38	45	35	30	32	30	44	30	40	45
Videotelephony (all %)	7	3	5	3	1	2	8	1	4	10	10	8	6	6	1	4	7	1	1	9	6	5	10	2	4
PS (%)	24	28	40	25	28	34	27	35	40	27	22	32	39	28	25	36	24	36	36	28	39	32	33	27	40
BS (%)	62	61	42	60	57	55	57	54	40	58	60	57	42	61	62	49	65	52	52	59	44	51	52	59	43
PBX (%)	14	11	18	15	15	11	16	11	20	15	18	11	19	11	13	15	11	12	12	13	17	17	15	14	17
Search video (all %)	15	18	19	20	16	20	16	17	19	18	20	16	19	18	15	17	20	20	17	20	18	18	17	20	18
PS (%)	5	7	10	7	10	2	5	1	4	6	8	5	7	8	10	6	9	9	1	7	9	9	1	6	8
BS (%)	48	36	50	38	47	45	48	47	44	52	45	42	40	38	41	38	44	32	44	42	38	47	47	46	51
PBX (%)	26	35	25	32	26	31	29	33	35	27	32	33	32	31	34	32	28	35	35	29	33	26	34	25	26
SC (%)	21	22	15	23	17	22	18	19	17	15	15	20	21	23	15	24	19	24	20	22	20	18	18	23	15
Documents Search (all %)	15	20	17	20	18	18	17	15	20	16	15	15	15	18	19	20	16	20	17	19	16	16	19	17	15
PS (%)	8	4	1	1	5	6	8	2	1	7	3	2	6	7	8	1	9	5	1	9	2	2	2	5	3
BS (%)	40	50	50	55	47	40	45	55	52	50	38	42	45	47	41	50	36	43	52	46	48	49	42	41	47
PBX (%)	27	27	30	26	30	33	27	26	32	26	34	35	32	29	28	32	32	31	32	27	29	31	35	32	26
SC (%)	25	19	19	18	18	21	20	17	15	17	25	21	17	17	23	17	23	21	15	18	21	18	21	22	24
Data transmission (all %)	30	26	29	23	31	30	26	37	26	29	25	32	29	26	35	30	27	28	34	23	29	28	27	30	29
BS (%)	63	65	59	57	69	62	62	66	70	69	59	70	64	69	66	67	68	64	68	59	66	68	63	61	58
PBX (%)	37	35	41	43	31	38	38	34	30	31	41	30	36	31	34	33	32	36	32	41	34	32	37	39	42

Variant 3

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	25	30	30	26	25	29	28	28	25	28	30	29	25	25	26	29	29	28	28	29	27	30	28	27	30
PS (%)	35	32	20	27	37	33	21	27	36	32	40	25	33	28	35	40	27	21	28	32	39	33	39	22	28
BS (%)	47	49	63	57	44	51	67	54	46	56	45	56	52	54	47	41	61	68	53	51	43	53	42	65	61
PBX (%)	18	19	17	16	19	16	12	19	18	12	15	19	15	18	18	19	12	11	19	17	18	14	19	13	11
Fax color (all %)	5	5	5	1	4	5	2	4	4	2	5	4	1	1	1	1	5	1	3	1	5	4	2	1	3
BS (%)	65	56	55	57	60	60	67	62	58	65	65	69	57	57	65	62	58	67	68	57	62	63	56	69	67
PBX (%)	35	44	45	43	40	40	33	38	42	35	35	31	43	43	35	38	42	33	32	43	38	37	44	31	33
Videotelephony (all %)	8	7	4	10	9	3	5	6	9	8	4	10	8	2	2	3	6	4	9	5	2	5	5	5	7
PS (%)	35	39	35	29	26	31	29	25	24	31	31	29	30	39	20	20	23	34	38	40	24	37	22	26	33
BS (%)	50	49	45	61	56	57	52	57	63	52	58	52	58	46	62	66	61	49	44	48	63	51	67	59	53
PBX (%)	15	12	20	10	18	12	19	18	13	17	11	19	12	15	18	14	16	17	18	12	13	12	11	15	14
Search video (all %)	19	18	16	15	16	16	20	20	16	15	15	15	17	18	17	18	15	16	16	17	15	17	17	19	17
PS (%)	8	9	4	6	6	7	1	2	2	2	7	7	7	7	1	1	10	1	4	4	3	3	6	6	4
BS (%)	49	40	47	42	49	50	47	53	38	50	46	41	36	48	54	49	45	54	51	45	50	49	45	39	45
PBX (%)	27	31	31	28	26	28	35	29	35	33	27	29	32	27	28	27	27	30	28	35	32	32	27	31	35
SC (%)	16	20	18	24	19	15	17	16	25	15	20	23	25	18	17	23	18	15	17	16	15	16	22	24	16
Documents Search (all %)	16	15	20	20	16	16	16	17	15	17	18	20	19	16	19	16	17	15	19	18	19	19	18	18	15
PS (%)	8	3	10	2	2	2	4	1	5	10	7	8	7	7	8	4	8	2	8	9	8	6	7	3	6
BS (%)	43	51	45	46	46	49	47	52	37	35	48	38	49	39	48	43	37	55	47	35	45	36	44	47	42
PBX (%)	30	25	25	32	27	25	27	26	35	34	28	29	29	32	28	31	34	27	26	32	26	33	33	31	27
SC (%)	19	21	20	20	25	24	22	21	23	21	17	25	15	22	16	22	21	16	19	24	21	25	16	19	25
Data transmission (all %)	27	25	25	28	30	31	29	25	31	30	28	22	30	38	35	33	28	36	25	30	32	25	30	30	28
BS (%)	67	68	56	60	60	67	62	56	62	60	61	62	59	63	55	62	66	60	59	57	66	67	56	61	61
PBX (%)	33	32	44	40	40	33	38	44	38	40	39	38	41	37	45	38	34	40	41	43	34	33	44	39	39

Variant 4

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	26	28	25	26	26	26	29	28	26	25	25	29	25	28	27	29	30	25	28	28	27	27	28	27	30
PS (%)	21	27	30	35	27	33	35	40	31	36	37	21	32	36	37	20	31	34	35	38	27	30	29	32	21
BS (%)	64	56	51	51	58	53	52	44	55	54	46	63	57	49	44	65	51	47	45	49	60	60	52	48	62
PBX (%)	15	17	19	14	15	14	13	16	14	10	17	16	11	15	19	15	18	19	20	13	13	10	19	20	17
Fax color (all %)	3	3	4	3	5	1	4	4	3	1	1	2	3	3	4	3	5	1	4	5	3	2	2	3	4
BS (%)	61	62	68	58	60	55	69	68	62	65	56	63	66	61	61	60	56	60	67	59	64	60	60	61	57
PBX (%)	39	38	32	42	40	45	31	32	38	35	44	37	34	39	39	40	44	40	33	41	36	40	40	39	43
Videotelephony (all %)	5	10	4	1	3	3	2	4	1	5	9	5	7	6	4	5	2	5	9	4	5	3	1	2	7
PS (%)	27	35	40	28	24	34	21	32	30	21	30	22	22	36	26	20	22	38	31	26	30	27	22	40	25
BS (%)	62	45	50	53	62	56	69	51	60	63	56	59	67	49	63	66	62	44	56	60	57	59	60	43	60
PBX (%)	11	20	10	19	14	10	10	17	10	16	14	19	11	15	11	14	16	18	13	14	13	14	18	17	15
Search video (all %)	19	15	17	16	18	20	17	17	20	16	20	20	17	15	19	19	17	15	20	15	19	18	17	18	18
PS (%)	4	7	6	4	3	6	5	3	2	4	3	10	9	1	9	7	5	7	5	1	9	1	9	5	3
BS (%)	44	39	54	49	48	42	46	51	49	54	47	41	50	54	37	51	49	42	46	50	48	40	44	47	54
PBX (%)	32	35	25	26	31	31	29	27	29	26	31	27	25	30	32	25	31	33	32	32	25	34	30	27	28
SC (%)	20	19	15	21	18	21	20	19	20	16	19	22	16	15	22	17	15	18	17	17	18	25	17	21	15
Documents Search (all %)	16	17	18	17	19	15	18	17	15	18	16	17	16	20	20	16	16	16	17	20	16	17	19	18	20
PS (%)	9	5	5	3	1	1	6	9	1	6	6	3	10	10	5	6	8	3	2	9	5	4	8	9	10
BS (%)	49	50	49	48	48	44	49	42	47	48	47	44	46	40	53	47	42	51	49	46	47	52	44	46	41
PBX (%)	26	29	29	27	28	34	25	26	30	27	31	35	29	29	25	31	28	30	28	26	25	29	30	30	32
SC (%)	16	16	17	22	23	21	20	23	22	19	16	18	15	21	17	16	22	16	21	19	23	15	18	15	17
Data transmission (all %)	31	27	32	37	29	35	30	30	35	35	29	27	32	28	26	28	30	38	22	28	30	33	33	32	21
BS (%)	68	64	59	65	64	65	67	64	69	61	69	57	68	67	65	59	61	66	55	56	64	60	55	62	61
PBX (%)	32	36	41	35	36	35	33	36	31	39	31	43	32	33	35	41	39	34	45	44	36	40	45	38	39

Variant 5

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	28	27	30	26	28	26	27	27	28	30	30	28	27	27	25	28	25	30	26	27	28	25	26	25	25
PS (%)	22	21	23	32	33	32	33	20	21	40	40	27	27	24	23	31	30	26	25	32	31	26	25	31	29
BS (%)	67	62	62	48	56	54	47	70	59	40	48	63	56	62	63	49	57	57	61	51	51	55	62	56	60
PBX (%)	11	17	15	20	11	14	20	10	20	20	12	10	17	14	14	20	13	17	14	17	18	19	13	13	11
Fax color (all %)	4	1	4	1	3	2	2	1	5	4	1	2	3	4	3	5	2	1	1	5	4	4	1	2	3
BS (%)	62	55	64	69	66	68	69	67	57	67	61	67	65	67	70	69	59	70	65	56	56	59	63	62	70
PBX (%)	38	45	36	31	34	32	31	33	43	33	39	33	35	33	30	31	41	30	35	44	44	41	37	38	30
Videotelephony (all %)	10	3	8	9	6	4	3	8	1	3	7	7	4	1	10	4	6	7	1	10	7	3	2	5	6
PS (%)	24	20	20	28	29	27	29	39	20	21	24	36	20	22	28	21	27	32	39	34	22	28	37	34	24
BS (%)	62	64	66	62	53	54	56	41	64	64	56	51	63	64	54	59	61	50	41	56	67	56	47	52	62
PBX (%)	14	16	14	10	18	19	15	20	16	15	20	13	17	14	18	20	12	18	20	10	11	16	16	14	14
Search video (all %)	17	16	18	18	18	18	15	15	15	16	19	20	15	16	20	16	17	19	17	19	15	18	16	19	15
PS (%)	4	2	8	5	6	3	9	6	7	3	9	6	6	2	8	4	4	10	5	1	1	7	1	7	6
BS (%)	37	49	43	49	42	44	48	44	47	49	40	47	50	51	42	49	40	31	44	49	51	52	54	49	51
PBX (%)	34	27	32	30	33	34	25	30	30	28	27	29	26	32	28	27	32	35	27	34	25	25	25	29	28
SC (%)	25	22	17	16	19	19	18	20	16	20	24	18	18	15	22	20	24	24	24	16	23	16	20	15	15
Documents Search (all %)	17	20	20	18	16	15	16	16	15	15	18	18	19	20	18	20	16	18	18	15	18	16	17	15	20
PS (%)	4	3	9	5	3	6	7	8	1	9	4	9	7	10	10	10	2	10	4	9	6	8	8	7	9
BS (%)	51	46	33	54	47	49	40	44	53	39	46	34	48	39	39	33	53	37	43	41	44	33	45	36	34
PBX (%)	27	31	33	26	35	30	35	30	31	28	35	33	25	35	34	34	28	30	31	34	31	35	27	33	32
SC (%)	18	20	25	15	15	15	18	18	15	24	15	24	20	16	17	23	17	23	22	16	19	24	20	24	25
Data transmission (all %)	24	33	20	28	29	35	37	33	36	32	25	25	32	32	24	27	34	25	37	24	28	34	38	34	31
BS (%)	63	65	63	68	61	70	58	69	69	68	62	64	70	60	61	70	66	62	69	69	56	58	56	62	55
PBX (%)	37	35	37	32	39	30	42	31	31	32	38	36	30	40	39	30	34	38	31	31	44	42	44	38	45

Variant 6

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	26	25	29	27	27	30	26	28	26	28	28	28	25	25	29	28	29	27	30	27	26	28	30	25	28
PS (%)	24	21	27	24	39	36	20	38	31	28	32	28	21	38	20	36	29	24	26	21	34	28	30	24	36
BS (%)	56	68	54	63	42	46	68	48	52	59	53	58	65	44	64	52	51	66	58	59	52	61	55	60	46
PBX (%)	20	11	19	13	19	18	12	14	17	13	15	14	14	18	16	12	20	10	16	20	14	11	15	16	18
Fax color (all %)	4	3	1	3	2	2	1	1	1	3	4	5	2	1	3	1	4	5	5	4	4	2	3	4	1
BS (%)	66	62	70	70	59	63	64	57	69	66	60	61	66	56	57	67	65	63	57	59	66	56	59	70	69
PBX (%)	34	38	30	30	41	37	36	43	31	34	40	39	34	44	43	33	35	37	43	41	34	44	41	30	31
Videotelephony (all %)	7	10	9	4	10	8	1	1	2	4	2	7	2	10	2	2	1	3	10	5	9	6	8	7	6
PS (%)	32	23	21	34	23	36	37	31	22	37	40	35	29	25	30	27	22	21	27	27	24	24	33	34	33
BS (%)	51	62	67	56	66	45	49	59	68	47	40	51	59	58	51	61	59	68	62	60	57	56	48	47	55
PBX (%)	17	15	12	10	11	19	14	10	10	16	20	14	12	17	19	12	19	11	11	13	19	20	19	19	12
Search video (all %)	19	18	15	18	16	16	20	17	15	16	20	18	17	18	17	16	15	17	16	15	15	18	18	17	18
PS (%)	2	6	2	1	6	10	5	4	9	2	7	6	10	4	8	6	1	4	8	6	10	2	6	4	7
BS (%)	40	41	47	48	37	39	55	44	44	45	50	50	40	50	43	44	53	53	47	46	35	45	38	48	47
PBX (%)	35	33	33	29	34	28	25	29	31	33	27	28	26	25	28	25	31	27	27	32	35	28	35	27	27
SC (%)	23	20	18	22	23	23	15	23	16	20	16	16	24	21	21	25	15	16	18	16	20	25	21	21	19
Documents Search (all %)	19	15	15	15	15	19	20	15	17	15	18	20	17	17	15	19	17	19	18	17	17	19	20	20	15
PS (%)	5	10	4	10	1	10	9	10	6	10	3	9	10	8	6	7	2	5	8	3	3	1	8	8	3
BS (%)	51	34	41	34	45	45	47	44	48	42	49	41	39	38	40	36	51	44	41	52	40	48	39	46	49
PBX (%)	27	33	30	31	29	26	25	29	30	29	31	26	29	31	35	32	27	31	26	27	34	30	28	30	29
SC (%)	17	23	25	25	25	19	19	17	16	19	17	24	22	23	19	25	20	20	25	18	23	21	25	16	19
Data transmission (all %)	25	29	31	33	30	25	32	38	39	34	28	22	37	29	34	34	34	29	21	32	29	27	21	27	32
BS (%)	64	69	65	65	64	59	62	68	58	60	69	66	62	55	70	58	61	59	65	59	69	58	70	55	55
PBX (%)	36	31	35	35	36	41	38	32	42	40	31	34	38	45	30	42	39	41	35	41	31	42	30	45	45

Variant 7

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	29	28	30	29	27	25	25	28	25	27	25	27	27	28	25	25	30	29	30	28	25	28	27	30
PS (%)	30	32	25	36	29	30	23	34	26	26	39	28	20	20	32	20	33	31	22	31	21	40	30	39	28
BS (%)	58	56	65	44	60	51	63	56	55	60	45	52	64	62	50	62	56	59	61	54	64	49	54	51	54
PBX (%)	12	12	10	20	11	19	14	10	19	14	16	20	16	18	18	18	11	10	17	15	15	11	16	10	18
Fax color (all %)	5	3	5	4	5	5	4	4	2	3	4	2	1	4	2	1	2	2	1	2	4	1	2	4	4
BS (%)	68	63	66	57	65	69	64	64	64	60	65	57	65	70	67	68	69	66	55	65	58	64	61	63	65
PBX (%)	32	37	34	43	35	31	36	36	36	40	35	43	35	30	33	32	31	34	45	35	42	36	39	37	35
Videotelephony (all %)	7	4	8	1	8	9	7	6	6	2	5	8	4	4	2	10	10	6	8	1	6	5	3	10	9
PS (%)	35	25	28	29	34	25	30	34	40	33	20	25	33	28	37	23	34	31	21	30	21	21	34	24	38
BS (%)	54	56	54	51	49	62	60	56	43	56	63	60	47	59	46	63	49	50	69	54	61	61	47	64	50
PBX (%)	11	19	18	20	17	13	10	10	17	11	17	15	20	13	17	14	17	19	10	16	18	18	19	12	12
Search video (all %)	15	15	15	16	20	15	16	17	15	17	19	15	19	16	17	20	19	16	19	16	16	19	16	20	20
PS (%)	10	3	1	4	6	9	6	9	1	4	1	3	5	7	4	6	7	9	5	8	8	10	6	8	8
BS (%)	47	49	48	46	46	50	37	46	44	46	44	53	52	44	41	38	37	50	36	44	42	44	41	37	46
PBX (%)	27	32	31	28	25	26	34	27	33	31	35	26	28	34	35	34	33	25	34	29	26	25	31	35	28
SC (%)	16	16	20	22	23	15	23	18	22	19	20	18	15	15	20	22	23	16	25	19	24	21	22	20	18
Documents Search (all %)	19	15	16	19	18	15	18	16	16	15	19	18	20	19	19	19	16	17	18	20	18	15	17	20	20
PS (%)	5	7	2	2	9	5	5	9	1	2	6	5	1	8	6	10	1	2	5	3	9	5	3	6	6
BS (%)	53	47	48	44	32	44	38	41	54	49	38	46	42	42	47	38	50	45	44	51	48	46	40	52	43
PBX (%)	27	28	32	34	34	26	33	26	29	34	33	28	34	30	31	29	26	35	28	28	27	28	34	26	27
SC (%)	15	18	18	20	25	25	24	24	16	15	23	21	23	20	16	23	23	18	23	18	16	21	23	16	24
Data transmission (all %)	25	34	28	30	20	29	30	32	33	38	26	32	29	30	32	25	28	29	25	31	28	35	34	19	17
BS (%)	66	70	60	67	69	63	60	57	66	66	70	57	56	63	57	67	57	70	55	55	67	55	62	69	56
PBX (%)	34	30	40	33	31	37	40	43	34	34	30	43	44	37	43	33	43	30	45	45	33	45	38	31	44

Variant 8

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	25	27	25	26	25	25	27	26	30	29	29	26	29	25	30	26	26	27	30	30	29	28	30	28	25
PS (%)	26	36	23	33	30	40	25	35	31	40	25	34	30	38	23	31	26	33	38	25	40	26	30	37	31
BS (%)	63	51	62	47	60	41	57	55	51	47	55	46	56	45	67	52	55	47	42	62	47	64	52	44	54
PBX (%)	11	13	15	20	10	19	18	10	18	13	20	20	14	17	10	17	19	20	20	13	13	10	18	19	15
Fax color (all %)	2	5	4	5	5	5	1	4	5	2	4	4	2	5	4	1	1	1	2	5	2	3	1	1	4
BS (%)	64	70	64	59	65	64	67	70	69	60	56	67	59	59	63	67	67	59	55	68	61	61	66	55	56
PBX (%)	36	30	36	41	35	36	33	30	31	40	44	33	41	41	37	33	33	41	45	32	39	39	34	45	44
Videotelephony (all %)	4	6	8	2	1	8	4	3	7	9	10	4	2	8	4	2	6	6	7	10	8	3	9	6	9
PS (%)	39	33	25	20	24	20	35	32	37	35	31	30	37	37	35	36	24	26	26	29	40	23	25	30	22
BS (%)	51	47	63	70	59	65	49	56	45	51	56	51	51	46	51	46	56	61	54	60	49	64	57	51	61
PBX (%)	10	20	12	10	17	15	16	12	18	14	13	19	12	17	14	18	20	13	20	11	11	13	18	19	17
Search video (all %)	18	16	20	15	20	18	17	18	17	16	15	17	17	16	16	19	19	19	20	17	18	18	19	17	18
PS (%)	10	5	7	7	8	4	5	5	6	10	1	1	2	6	7	6	6	10	1	9	10	3	3	2	2
BS (%)	36	44	51	47	38	45	40	48	49	46	52	58	48	45	39	36	46	43	47	44	43	50	55	49	48
PBX (%)	35	27	27	29	33	32	30	28	29	26	31	26	35	28	31	33	29	30	29	29	32	30	26	34	34
SC (%)	19	24	15	17	21	19	25	19	16	18	16	15	15	21	23	25	19	17	23	18	15	17	16	15	16
Documents Search (all %)	17	15	19	20	19	18	17	20	20	20	15	19	20	16	18	17	20	17	20	20	19	17	16	17	17
PS (%)	6	9	7	2	7	4	7	6	6	8	5	10	4	1	2	2	1	2	8	2	6	2	3	2	10
BS (%)	47	46	41	47	46	49	50	40	43	41	47	41	49	41	53	52	54	41	48	52	37	40	50	49	41
PBX (%)	31	28	33	26	32	32	28	35	32	34	33	31	31	35	25	26	28	35	27	30	35	33	28	33	29
SC (%)	16	17	19	25	15	15	15	19	19	17	15	18	16	23	20	20	17	22	17	16	22	25	19	16	20
Data transmission (all %)	34	31	24	32	30	26	34	29	21	24	27	30	30	30	28	35	28	30	21	18	24	31	25	31	27
BS (%)	66	64	62	55	55	60	64	63	70	65	60	66	64	65	66	62	67	58	66	69	64	62	60	70	55
PBX (%)	34	36	38	45	45	40	36	37	30	35	40	34	36	35	34	38	33	42	34	31	36	38	40	30	45

Variant 9

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	28	25	27	28	26	27	27	27	29	29	27	26	26	30	26	29	28	30	30	26	29	29	28	28
PS (%)	37	20	26	40	25	28	33	25	31	33	38	29	34	35	40	31	34	35	39	29	32	33	36	25	28
BS (%)	43	65	61	43	56	62	51	58	53	52	44	55	55	46	42	56	50	55	44	51	48	57	49	61	60
PBX (%)	20	15	13	17	19	10	16	17	16	15	18	16	11	19	18	13	16	10	17	20	20	10	15	14	12
Fax color (all %)	2	2	3	3	3	4	3	5	1	4	4	3	1	1	3	3	3	4	3	5	2	4	5	3	2
BS (%)	66	63	60	70	56	62	68	70	64	63	61	56	58	65	56	59	55	70	70	65	69	61	69	57	69
PBX (%)	34	37	40	30	44	38	32	30	36	37	39	44	42	35	44	41	45	30	30	35	31	39	31	43	31
Videotelephony (all %)	9	9	2	9	4	8	5	7	7	6	8	5	9	3	9	1	10	8	10	6	9	3	8	9	7
PS (%)	28	32	39	33	20	25	34	30	40	27	38	36	27	36	28	28	21	32	26	28	23	37	32	36	33
BS (%)	55	58	42	50	65	59	53	50	44	57	50	48	62	44	58	55	69	51	54	62	64	45	48	45	47
PBX (%)	17	10	19	17	15	16	13	20	16	16	12	16	11	20	14	17	10	17	20	10	13	18	20	19	20
Search video (all %)	19	15	19	15	17	19	18	20	16	19	18	16	18	16	15	19	16	20	15	19	17	15	16	15	19
PS (%)	5	5	3	3	6	5	3	2	5	4	2	1	3	2	9	8	10	9	6	4	6	4	1	8	10
BS (%)	44	37	55	42	49	53	48	46	41	44	50	47	54	46	41	49	43	35	51	48	42	44	48	47	40
PBX (%)	29	33	26	34	26	27	28	33	33	31	29	31	27	33	28	27	32	34	26	33	34	34	34	26	25
SC (%)	22	25	16	21	19	15	21	19	21	21	19	21	16	19	22	16	15	22	17	15	18	18	17	19	25
Documents Search (all %)	16	16	19	20	15	16	20	17	19	15	15	19	16	20	15	20	18	18	20	20	20	15	18	19	15
PS (%)	1	7	10	3	9	9	7	5	5	10	3	5	10	10	7	4	4	9	1	2	7	6	3	9	8
BS (%)	47	42	36	42	44	43	41	53	49	43	45	52	31	41	38	50	56	37	50	46	45	43	39	41	45
PBX (%)	30	27	34	33	25	25	35	25	30	32	34	26	34	27	31	26	25	32	27	35	26	35	33	32	26
SC (%)	22	24	20	22	22	23	17	17	16	15	18	17	25	22	24	20	15	22	22	17	22	16	25	18	21
Data transmission (all %)	25	30	32	26	33	27	27	24	30	27	26	30	30	34	28	31	24	22	22	20	26	34	24	26	29
BS (%)	60	64	64	56	67	62	69	67	69	70	67	56	65	57	60	55	70	69	63	64	70	59	59	68	63
PBX (%)	40	36	36	44	33	38	31	33	31	30	33	44	35	43	40	45	30	31	37	36	30	41	41	32	37

Variant 10

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	27	25	29	28	25	27	29	27	28	28	29	25	25	29	28	28	26	29	26	25	27	28	29	26
PS (%)	27	30	40	20	40	21	30	31	30	31	39	40	38	38	25	25	22	22	29	28	24	23	30	29	24
BS (%)	63	59	41	67	41	62	60	56	55	58	49	49	51	48	63	56	63	63	60	58	57	61	51	51	66
PBX (%)	10	11	19	13	19	17	10	13	15	11	12	11	11	14	12	19	15	15	11	14	19	16	19	20	10
Fax color (all %)	2	4	4	4	1	4	2	4	2	2	1	5	5	2	2	3	4	3	5	3	1	1	5	4	4
BS (%)	70	70	67	56	65	58	63	60	61	63	60	66	60	70	60	59	61	63	62	69	64	59	66	65	69
PBX (%)	30	30	33	44	35	42	37	40	39	37	40	34	40	30	40	41	39	37	38	31	36	41	34	35	31
Videotelephony (all %)	6	6	2	4	7	2	3	10	8	8	2	5	7	1	1	8	5	4	8	10	1	5	4	1	7
PS (%)	28	25	31	30	26	26	34	35	33	35	24	26	27	30	21	26	28	34	27	33	38	24	40	28	34
BS (%)	59	63	59	50	63	54	50	52	53	55	61	63	53	55	60	62	52	53	58	49	49	61	45	55	56
PBX (%)	13	12	10	20	11	20	16	13	14	10	15	11	20	15	19	12	20	13	15	18	13	15	15	17	10
Search video (all %)	19	20	20	18	18	20	20	20	20	16	17	17	18	15	16	17	18	16	17	19	20	19	15	17	19
PS (%)	8	4	2	3	1	7	4	5	2	8	5	6	2	8	5	5	1	7	3	3	9	4	10	10	6
BS (%)	42	46	54	57	48	41	49	41	54	46	42	45	47	39	45	48	50	42	48	40	41	42	49	40	51
PBX (%)	32	29	29	25	29	34	31	35	25	27	32	32	30	29	31	28	34	29	28	33	25	29	25	27	26
SC (%)	18	21	15	15	22	18	16	19	19	19	21	17	21	24	19	19	15	22	21	24	25	25	16	23	17
Documents Search (all %)	17	15	18	15	18	18	16	20	19	20	20	19	19	15	16	17	18	16	18	20	16	16	19	16	20
PS (%)	2	3	5	8	7	3	9	7	10	1	2	5	3	8	3	1	4	4	4	6	4	8	3	10	2
BS (%)	48	51	44	33	51	48	37	42	44	44	49	47	43	40	49	52	43	43	48	46	52	48	45	38	49
PBX (%)	26	26	28	35	27	29	33	31	26	31	26	27	35	31	29	32	31	30	30	25	26	27	30	27	31
SC (%)	24	20	23	24	15	20	21	20	20	24	23	21	19	21	19	15	22	23	18	23	18	17	22	25	18
Data transmission (all %)	27	28	31	30	28	31	32	17	24	26	32	25	26	42	36	27	27	35	23	22	37	32	29	33	24
BS (%)	59	66	65	67	69	67	56	65	57	61	57	56	55	66	68	58	63	64	57	69	65	57	56	59	61
PBX (%)	41	34	35	33	31	33	44	35	43	39	43	44	45	34	32	42	37	36	43	31	35	43	44	41	39

Variant 11

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	27	26	26	27	26	30	28	28	25	27	29	27	28	29	29	26	25	30	29	30	28	25	28	27	29
PS (%)	23	29	27	22	40	25	22	37	34	39	36	29	26	30	26	40	36	39	34	27	22	24	40	32	26
BS (%)	62	56	60	67	47	55	63	53	46	47	48	52	59	54	58	44	45	43	52	62	67	58	49	52	61
PBX (%)	15	15	13	11	13	20	15	10	20	14	16	19	15	16	16	16	19	18	14	11	11	18	11	16	13
Fax color (all %)	1	2	3	5	3	1	3	2	2	2	1	1	3	4	5	2	1	4	1	5	5	5	4	4	2
BS (%)	56	56	63	59	55	63	64	68	57	57	66	63	60	69	70	60	65	67	61	58	57	67	69	59	66
PBX (%)	44	44	37	41	45	37	36	32	43	43	34	37	40	31	30	40	35	33	39	42	43	33	31	41	34
Videotelephony (all %)	6	9	10	1	4	3	8	4	2	5	5	6	8	6	1	6	4	6	6	5	7	4	9	3	10
PS (%)	22	40	30	38	28	27	40	29	21	22	37	28	22	25	20	35	31	36	33	28	27	33	33	30	30
BS (%)	67	40	51	50	62	55	44	54	65	58	47	57	68	60	60	47	58	50	50	58	57	50	48	56	56
PBX (%)	11	20	19	12	10	18	16	17	14	20	16	15	10	15	20	18	11	14	17	14	16	17	19	14	14
Search video (all %)	18	15	17	20	20	17	20	17	18	15	19	17	18	16	20	19	20	19	17	17	18	18	17	17	19
PS (%)	10	6	5	1	5	1	10	5	9	4	3	8	1	6	5	9	3	7	5	10	3	7	5	9	1
BS (%)	43	49	51	50	41	45	36	37	37	54	43	43	44	49	49	38	48	43	43	42	52	46	45	44	44
PBX (%)	27	30	29	26	34	35	31	35	30	27	31	32	34	29	29	28	27	29	27	33	29	28	34	26	30
SC (%)	20	15	15	23	20	19	23	23	24	15	23	17	21	16	17	25	22	21	25	15	16	19	16	21	25
Documents Search (all %)	15	19	18	17	19	19	19	19	16	18	19	15	19	16	18	15	15	19	17	15	16	16	15	20	17
PS (%)	2	1	3	9	4	8	4	6	4	3	4	10	4	7	3	4	2	10	1	6	9	2	7	7	5
BS (%)	49	51	49	34	49	46	50	49	38	39	47	42	47	43	45	55	54	34	50	45	49	44	35	45	53
PBX (%)	34	29	28	34	29	26	27	25	33	33	26	26	25	27	33	25	27	31	29	34	27	34	34	30	26
SC (%)	15	19	20	23	18	20	19	20	25	25	23	22	24	23	19	16	17	25	20	15	15	20	24	18	16
Data transmission (all %)	33	29	26	30	28	30	22	30	37	33	27	34	24	29	27	32	35	22	30	28	26	32	27	29	23
BS (%)	60	65	59	68	56	68	68	68	63	66	56	62	63	57	69	66	58	58	61	64	63	69	63	56	61
PBX (%)	40	35	41	32	44	32	32	32	37	34	44	38	37	43	31	34	42	42	39	36	37	31	37	44	39

Variant 12

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	30	26	29	30	30	29	25	30	28	26	26	29	26	28	26	28	28	29	26	26	30	30	30	29	26
PS (%)	28	22	34	28	30	23	34	27	28	21	32	24	24	37	26	39	39	30	40	31	29	20	29	40	38
BS (%)	56	60	47	58	56	65	55	60	62	63	57	66	61	45	63	44	42	51	40	57	60	61	55	43	49
PBX (%)	16	18	19	14	14	12	11	13	10	16	11	10	15	18	11	17	19	19	20	12	11	19	16	17	13
Fax color (all %)	3	4	1	5	3	1	4	5	5	4	5	2	4	5	2	1	4	2	1	2	2	1	2	5	1
BS (%)	68	63	62	61	56	60	67	58	62	58	58	58	70	58	66	59	64	60	61	62	59	65	58	68	57
PBX (%)	32	37	38	39	44	40	33	42	38	42	42	42	30	42	34	41	36	40	39	38	41	35	42	32	43
Videotelephony (all %)	2	1	10	1	8	2	5	2	3	1	10	10	6	9	3	8	9	6	4	4	10	2	5	10	9
PS (%)	39	40	39	20	31	34	35	40	31	36	39	25	39	25	30	39	34	22	29	39	37	27	36	27	27
BS (%)	47	46	44	63	55	53	50	48	50	49	45	63	44	63	60	46	48	66	51	49	49	57	53	60	60
PBX (%)	14	14	17	17	14	13	15	12	19	15	16	12	17	12	10	15	18	12	20	12	14	16	11	13	13
Search video (all %)	19	19	19	16	17	17	18	16	17	18	19	17	19	20	16	15	17	19	16	15	18	20	18	17	15
PS (%)	5	3	7	9	2	10	3	5	8	5	8	10	3	10	2	4	6	3	5	6	9	5	7	7	9
BS (%)	48	47	46	45	49	37	45	45	49	36	45	32	45	44	52	50	54	51	48	36	48	35	43	41	43
PBX (%)	26	28	28	29	33	32	30	27	28	35	29	35	33	26	28	30	25	26	25	35	27	35	31	27	27
SC (%)	21	22	19	17	16	21	22	23	15	24	18	23	19	20	18	16	15	20	22	23	16	25	19	25	21
Documents Search (all %)	18	18	19	17	19	20	17	16	19	16	20	20	18	17	16	17	17	17	17	20	15	16	18	16	19
PS (%)	2	2	7	9	2	6	6	3	9	9	3	5	6	10	9	5	2	10	4	5	6	9	7	3	9
BS (%)	43	50	43	35	40	41	39	46	38	42	45	48	43	43	40	47	57	42	53	44	38	38	35	41	51
PBX (%)	35	26	25	35	35	29	30	31	33	30	33	25	30	29	35	30	26	27	25	33	32	35	35	34	25
SC (%)	20	22	25	21	23	24	25	20	20	19	19	22	21	18	16	18	15	21	18	18	24	18	23	22	15
Data transmission (all %)	28	32	22	31	23	31	31	31	28	35	20	22	27	21	37	31	25	27	36	33	25	31	27	23	30
BS (%)	58	58	58	70	57	64	70	56	66	64	60	69	69	57	61	60	66	61	55	60	57	58	59	55	59
PBX (%)	42	42	42	30	43	36	30	44	34	36	40	31	31	43	39	40	34	39	45	40	43	42	41	45	41

Variant 13

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	28	25	26	28	26	27	26	26	28	27	25	30	30	27	30	26	25	27	27	28	25	25	30	29
PS (%)	28	37	26	24	34	21	31	28	38	24	33	29	38	23	32	28	36	21	29	24	31	36	23	38	24
BS (%)	55	52	54	63	52	63	58	61	52	56	56	51	47	66	58	56	45	67	52	66	59	53	62	48	65
PBX (%)	17	11	20	13	14	16	11	11	10	20	11	20	15	11	10	16	19	12	19	10	10	11	15	14	11
Fax color (all %)	2	5	4	2	5	4	1	5	5	1	4	5	2	4	4	2	5	5	1	1	1	2	5	2	3
BS (%)	55	57	59	57	63	58	68	59	58	60	63	63	70	65	61	68	68	56	60	60	68	65	61	70	55
PBX (%)	45	43	41	43	37	42	32	41	42	40	37	37	30	35	39	32	32	44	40	40	32	35	39	30	45
Videotelephony (all %)	7	4	3	8	10	2	6	5	2	8	7	1	3	4	8	6	2	8	6	10	10	1	4	2	7
PS (%)	40	30	23	24	39	31	26	30	26	20	38	22	20	37	36	22	22	20	21	30	32	32	35	25	29
BS (%)	47	52	59	60	46	51	58	58	64	69	44	65	61	44	50	60	67	60	66	55	50	54	48	58	52
PBX (%)	13	18	18	16	15	18	16	12	10	11	18	13	19	19	14	18	11	20	13	15	18	14	17	17	19
Search video (all %)	18	16	16	20	17	16	17	15	19	18	20	19	18	17	19	19	18	18	15	15	15	15	18	19	20
PS (%)	5	7	7	9	4	6	6	8	3	4	4	5	9	10	10	1	5	6	5	5	9	10	9	9	2
BS (%)	40	47	45	46	43	50	47	36	44	39	47	48	46	40	47	58	44	38	45	46	42	35	43	41	48
PBX (%)	33	25	29	26	29	29	30	35	34	32	30	31	27	33	28	26	30	32	35	30	32	31	30	34	32
SC (%)	22	21	19	19	24	15	17	21	19	25	19	16	18	17	15	15	21	24	15	19	17	24	18	16	18
Documents Search (all %)	15	18	17	15	19	17	18	17	16	15	18	18	18	19	17	18	20	16	15	18	15	18	18	17	15
PS (%)	7	10	10	10	3	1	6	1	8	1	10	10	2	9	4	8	5	6	6	5	6	3	6	10	6
BS (%)	44	35	36	41	49	45	41	50	43	43	34	37	45	41	45	43	46	47	46	38	46	40	46	43	45
PBX (%)	31	33	35	27	25	29	33	28	28	35	31	28	30	29	27	27	31	32	33	35	31	34	26	31	29
SC (%)	18	22	19	22	23	25	20	21	21	21	25	25	23	21	24	22	18	15	15	22	17	23	22	16	20
Data transmission (all %)	29	29	35	29	21	35	31	32	32	30	24	32	29	26	25	25	29	28	36	29	31	39	30	30	26
BS (%)	66	57	59	70	68	65	58	59	63	67	67	58	69	63	69	67	68	69	66	70	62	69	57	67	66
PBX (%)	34	43	41	30	32	35	42	41	37	33	33	42	31	37	31	33	32	31	34	30	38	31	43	33	34

Variant 14

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	30	29	26	30	29	26	28	29	27	28	28	28	30	30	28	26	27	25	27	30	29	25	25	27	30
PS (%)	29	35	29	35	39	24	38	23	26	31	23	29	31	36	27	32	34	38	29	32	33	37	27	30	31
BS (%)	51	55	54	54	44	61	43	57	62	51	58	54	52	44	56	55	46	42	56	50	56	44	62	59	57
PBX (%)	20	10	17	11	17	15	19	20	12	18	19	17	17	20	17	13	20	20	15	18	11	19	11	11	12
Fax color (all %)	1	1	4	2	2	3	4	4	5	3	5	2	4	4	3	1	1	3	3	3	4	3	5	2	5
BS (%)	60	65	66	59	56	70	64	65	55	61	63	58	56	55	65	68	59	66	69	64	64	63	59	63	70
PBX (%)	40	35	34	41	44	30	36	35	45	39	37	42	44	45	35	32	41	34	31	36	36	37	41	37	30
Videotelephony (all %)	3	10	3	3	3	6	3	8	2	9	2	1	10	2	9	3	7	3	5	4	2	4	10	3	7
PS (%)	31	36	28	34	38	23	39	25	31	40	36	25	33	22	21	32	21	34	34	27	38	32	34	29	21
BS (%)	56	51	60	54	47	63	50	55	58	41	49	64	56	61	68	51	64	46	54	58	50	53	50	53	66
PBX (%)	13	13	12	12	15	14	11	20	11	19	15	11	11	17	11	17	15	20	12	15	12	15	16	18	13
Search video (all %)	15	18	20	15	17	15	17	18	15	19	16	18	15	20	17	20	17	17	15	18	16	16	15	18	17
PS (%)	2	1	1	4	4	2	2	5	4	2	1	4	3	1	10	2	1	8	7	9	8	5	3	5	3
BS (%)	53	49	48	44	37	54	52	47	53	46	45	39	44	48	37	53	44	40	48	43	45	49	46	52	54
PBX (%)	28	35	35	30	34	28	25	28	28	30	35	35	32	31	32	29	35	30	29	33	25	28	35	25	25
SC (%)	17	15	16	22	25	16	21	20	15	22	19	22	21	20	21	16	20	22	16	15	22	18	16	18	18
Documents Search (all %)	20	15	15	20	20	17	18	19	20	18	15	17	19	19	16	20	18	19	18	16	16	18	18	18	18
PS (%)	7	6	4	5	1	4	7	3	3	1	9	9	4	7	9	4	4	1	9	8	3	5	6	1	10
BS (%)	33	43	56	53	46	50	47	48	47	45	36	43	47	39	35	47	45	54	43	39	52	44	40	50	36
PBX (%)	35	29	25	26	34	31	29	32	32	31	32	26	28	30	33	30	34	27	33	32	28	34	31	33	32
SC (%)	25	22	15	16	19	15	17	17	18	23	23	22	21	24	23	19	17	18	15	21	17	17	23	16	22
Data transmission (all %)	31	27	32	30	29	33	30	22	31	23	34	34	22	25	27	30	30	33	32	29	33	34	27	32	23
BS (%)	64	57	58	63	68	68	59	55	66	56	55	56	58	55	60	68	60	64	59	58	56	66	68	57	62
PBX (%)	36	43	42	37	32	32	41	45	34	44	45	44	42	45	40	32	40	36	41	42	44	34	32	43	38

Variant 15

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	30	29	28	30	28	26	30	29	26	28	30	28	29	29	30	26	25	30	29	29	27	30	27	26	28
PS (%)	34	23	26	25	28	38	39	39	40	28	30	28	29	37	38	36	36	23	23	20	20	27	26	23	21
BS (%)	49	61	60	64	59	42	46	41	41	60	56	55	59	49	49	52	49	63	67	63	63	61	58	67	61
PBX (%)	17	16	14	11	13	20	15	20	19	12	14	17	12	14	13	12	15	14	10	17	17	12	16	10	18
Fax color (all %)	5	4	2	2	4	4	5	1	5	2	4	2	2	1	5	5	2	2	3	4	3	1	3	1	1
BS (%)	62	67	63	63	64	60	65	58	67	56	69	55	56	70	60	70	64	70	68	70	57	56	62	57	68
PBX (%)	38	33	37	37	36	40	35	42	33	44	31	45	44	30	40	30	36	30	32	30	43	44	38	43	32
Videotelephony (all %)	2	3	1	10	10	6	8	1	6	7	4	2	2	6	9	1	5	5	2	9	8	2	4	6	10
PS (%)	38	21	39	33	31	37	36	32	32	40	20	39	20	30	32	33	36	27	32	34	40	33	39	23	30
BS (%)	47	65	47	48	51	47	49	51	53	49	61	41	64	60	52	52	54	60	50	51	41	57	48	58	60
PBX (%)	15	14	14	19	18	16	15	17	15	11	19	20	16	10	16	15	10	13	18	15	19	10	13	19	10
Search video (all %)	18	17	15	20	16	15	20	20	16	16	15	15	18	19	19	19	17	18	18	20	17	19	20	16	15
PS (%)	10	8	9	7	3	1	2	10	6	3	4	1	7	4	5	1	7	4	4	1	6	2	2	8	3
BS (%)	48	45	49	41	45	52	56	37	51	48	51	53	46	42	44	46	39	45	47	49	40	47	38	40	42
PBX (%)	25	28	27	34	31	31	27	31	25	33	25	26	28	33	34	32	30	32	30	35	31	30	35	27	30
SC (%)	17	19	15	18	21	16	15	22	18	16	20	20	19	21	17	21	24	19	19	15	23	21	25	25	25
Documents Search (all %)	16	17	19	15	19	16	19	16	16	20	18	17	18	18	17	17	19	20	15	16	20	16	18	20	20
PS (%)	7	3	2	6	7	9	2	1	7	3	1	4	5	6	9	7	2	7	5	8	8	8	10	8	2
BS (%)	44	44	49	42	45	38	48	44	53	51	56	48	49	42	41	37	55	43	47	48	49	41	40	34	40
PBX (%)	29	29	33	33	33	35	31	34	25	30	28	33	27	34	34	31	27	25	28	27	26	27	32	34	35
SC (%)	20	24	16	19	15	18	19	21	15	16	15	15	19	18	16	25	16	25	20	17	17	24	18	24	23
Data transmission (all %)	29	30	35	23	23	33	18	33	31	27	29	36	31	27	20	32	32	25	33	22	25	32	28	31	26
BS (%)	63	55	67	62	69	68	70	56	70	59	68	61	65	60	60	59	69	55	61	67	68	61	57	69	60
PBX (%)	37	45	33	38	31	32	30	44	30	41	32	39	35	40	40	41	31	45	39	33	32	39	43	31	40

Variant 16

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	30	27	28	27	27	28	27	25	29	28	26	28	30	28	29	30	30	27	26	25	30	25	29	26
PS (%)	28	27	22	21	27	25	20	38	23	20	35	32	37	34	28	24	28	24	38	34	37	32	25	20	22
BS (%)	62	63	66	62	57	61	67	48	66	63	53	57	48	48	62	60	54	59	44	56	44	52	62	67	58
PBX (%)	10	10	12	17	16	14	13	14	11	17	12	11	15	18	10	16	18	17	18	10	19	16	13	13	20
Fax color (all %)	1	4	4	2	2	3	5	4	1	3	2	3	2	1	1	3	4	5	2	1	4	1	5	1	5
BS (%)	59	59	62	66	65	57	69	65	57	57	62	66	67	60	56	69	63	64	69	59	60	70	68	66	60
PBX (%)	41	41	38	34	35	43	31	35	43	43	38	34	33	40	44	31	37	36	31	41	40	30	32	34	40
Videotelephony (all %)	8	5	1	10	3	4	5	9	7	2	8	6	9	9	10	3	10	5	10	8	10	10	9	2	9
PS (%)	25	33	40	28	25	36	23	34	33	25	35	27	28	21	34	28	31	26	20	37	21	39	34	32	39
BS (%)	65	56	44	56	60	50	60	50	54	65	53	53	57	68	56	56	59	59	67	46	59	49	46	57	49
PBX (%)	10	11	16	16	15	14	17	16	13	10	12	20	15	11	10	16	10	15	13	17	20	12	20	11	12
Search video (all %)	17	18	15	20	17	19	16	15	19	16	19	19	17	20	19	19	18	16	20	16	15	19	18	20	20
PS (%)	9	9	5	9	5	5	10	4	10	9	4	8	3	2	7	1	5	4	8	2	6	4	9	2	6
BS (%)	49	39	50	42	47	48	38	51	45	36	46	37	52	42	42	53	48	48	37	47	42	42	40	51	45
PBX (%)	26	28	28	28	32	31	28	25	26	32	26	31	29	33	34	25	31	31	30	29	31	29	35	31	30
SC (%)	16	24	17	21	16	16	24	20	19	23	24	24	16	23	17	21	16	17	25	22	21	25	16	16	19
Documents Search (all %)	17	20	18	19	17	16	15	17	17	16	17	20	16	17	19	17	20	16	19	19	17	15	19	20	20
PS (%)	7	4	6	6	5	7	4	8	2	8	10	8	7	8	4	8	1	7	8	6	4	5	10	3	6
BS (%)	50	42	43	42	45	43	47	43	40	32	42	43	45	42	46	40	47	38	38	37	49	45	39	43	49
PBX (%)	26	34	27	31	25	35	31	25	33	35	33	30	29	33	33	33	34	30	32	34	27	25	30	34	30
SC (%)	17	20	24	21	25	15	18	24	25	25	15	19	19	17	17	19	18	25	22	23	20	25	21	20	15
Data transmission (all %)	28	23	35	21	34	31	31	28	31	34	26	26	28	23	23	29	18	28	22	30	29	25	24	28	20
BS (%)	60	63	65	63	69	62	55	60	56	56	55	66	69	59	65	67	60	57	69	62	61	65	68	66	56
PBX (%)	40	37	35	37	31	38	45	40	44	44	45	34	31	41	35	33	40	43	31	38	39	35	32	34	44

Variant 17

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	28	30	25	27	30	25	25	30	26	25	29	27	27	30	26	29	27	29	29	30	27	27	25	30
PS (%)	38	30	24	26	20	33	26	28	21	32	25	26	40	30	22	22	35	24	37	37	28	38	29	27	39
BS (%)	49	52	61	56	61	57	59	57	65	56	61	63	43	57	66	61	45	64	44	53	62	52	57	60	51
PBX (%)	13	18	15	18	19	10	15	15	14	12	14	11	17	13	12	17	20	12	19	10	10	10	14	13	10
Fax color (all %)	4	4	2	3	4	1	5	3	1	4	5	5	4	5	2	4	5	2	1	4	2	1	2	2	1
BS (%)	62	69	59	62	57	56	55	66	69	60	68	56	67	67	67	63	68	60	68	57	70	55	56	69	58
PBX (%)	38	31	41	38	43	44	45	34	31	40	32	44	33	33	33	37	32	40	32	43	30	45	44	31	42
Videotelephony (all %)	3	7	4	6	5	4	6	2	6	9	6	7	5	4	5	10	3	7	2	3	10	8	9	4	6
PS (%)	38	36	36	24	25	24	26	37	40	20	24	37	21	24	31	24	31	36	24	40	28	35	24	22	33
BS (%)	48	45	44	57	55	64	62	43	42	60	58	49	69	65	52	65	52	48	66	47	54	51	58	59	56
PBX (%)	14	19	20	19	20	12	12	20	18	20	18	14	10	11	17	11	17	16	10	13	18	14	18	19	11
Search video (all %)	19	19	15	15	15	15	18	19	19	20	17	19	19	15	19	15	16	18	17	19	15	18	17	20	16
PS (%)	4	8	10	4	2	6	8	1	9	2	4	7	4	7	9	2	9	1	3	5	2	4	5	8	4
BS (%)	45	43	33	47	46	44	44	48	36	45	44	47	46	44	43	45	44	52	49	52	50	48	45	48	45
PBX (%)	35	28	32	28	30	30	31	35	34	31	29	30	26	31	25	34	27	29	32	27	27	26	26	28	26
SC (%)	16	21	25	21	22	20	17	16	21	22	23	16	24	18	23	19	20	18	16	16	21	22	24	16	25
Documents Search (all %)	18	18	15	15	16	17	15	17	18	15	20	17	20	17	18	16	20	20	15	15	15	15	18	19	20
PS (%)	1	1	9	6	6	1	3	6	10	10	7	4	3	7	9	10	4	3	9	6	4	8	9	10	3
BS (%)	50	48	36	48	43	46	50	45	46	44	41	51	46	38	41	47	47	43	41	40	45	36	38	43	42
PBX (%)	30	27	33	31	34	33	31	31	25	26	27	30	26	30	33	27	25	32	26	33	35	32	29	28	31
SC (%)	19	24	22	15	17	20	16	18	19	20	25	15	25	25	17	16	24	22	24	21	16	24	24	19	24
Data transmission (all %)	27	24	34	36	33	33	31	34	26	26	27	23	25	32	26	29	27	26	36	30	28	31	27	30	27
BS (%)	66	60	65	61	62	62	57	61	67	58	60	70	67	64	57	57	61	64	63	70	64	58	64	61	62
PBX (%)	34	40	35	39	38	38	43	39	33	42	40	30	33	36	43	43	39	36	37	30	36	42	36	39	38

Variant 18

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	25	30	27	30	29	26	27	29	27	27	27	27	29	28	26	25	25	28	25	27	26	28	28	29	26
PS (%)	27	38	36	27	35	25	22	32	40	29	26	36	22	31	27	36	21	30	26	34	40	27	22	29	34
BS (%)	55	43	50	54	52	64	64	52	42	58	61	52	67	56	63	47	66	58	57	56	47	63	66	59	53
PBX (%)	18	19	14	19	13	11	14	16	18	13	13	12	11	13	10	17	13	12	17	10	13	10	12	12	13
Fax color (all %)	2	5	1	2	5	4	2	5	4	1	1	5	1	4	1	2	4	4	2	1	5	1	1	1	2
BS (%)	68	61	67	64	66	68	67	57	67	62	68	67	70	57	56	63	59	70	62	62	66	70	70	62	58
PBX (%)	32	39	33	36	34	32	33	43	33	38	32	33	30	43	44	37	41	30	38	38	34	30	30	38	42
Videotelephony (all %)	9	4	3	1	8	8	2	4	6	10	9	6	3	2	5	7	8	2	10	6	2	1	4	5	5
PS (%)	21	33	33	25	36	29	30	24	37	32	36	32	25	22	28	26	22	21	28	28	26	27	36	38	38
BS (%)	62	48	48	56	51	58	59	66	50	57	46	52	58	65	53	60	64	60	60	55	59	54	54	49	42
PBX (%)	17	19	19	19	13	13	11	10	13	11	18	16	17	13	19	14	14	19	12	17	15	19	10	13	20
Search video (all %)	19	19	17	19	17	18	16	19	18	18	17	15	20	15	15	19	19	15	20	20	20	16	17	16	17
PS (%)	6	7	9	4	6	7	8	4	5	5	7	2	3	3	4	8	9	9	10	4	5	4	4	8	9
BS (%)	41	39	41	39	46	43	45	41	48	46	47	54	39	46	46	45	40	47	46	43	37	55	45	41	35
PBX (%)	33	29	29	34	27	31	28	30	31	32	25	25	33	31	33	29	34	29	28	32	34	26	32	33	32
SC (%)	20	25	21	23	21	19	19	25	16	17	21	19	25	20	17	18	17	15	16	21	24	15	19	18	24
Documents Search (all %)	16	20	17	19	16	15	19	16	15	16	15	20	19	16	16	16	17	15	16	18	20	19	16	18	16
PS (%)	1	7	3	1	4	4	4	7	5	10	5	2	5	4	4	6	3	8	2	9	1	10	9	10	7
BS (%)	50	46	44	48	50	40	45	43	49	45	54	47	47	49	51	50	56	39	48	40	50	40	43	40	44
PBX (%)	31	31	32	27	29	31	34	32	26	30	25	35	32	27	25	27	25	34	34	28	29	29	31	27	31
SC (%)	18	16	21	24	17	25	17	18	20	15	16	16	16	20	20	17	16	19	16	23	20	21	17	23	18
Data transmission (all %)	29	22	35	29	25	29	34	27	30	28	31	27	28	35	37	31	27	36	27	28	27	35	34	31	34
BS (%)	62	58	62	69	60	63	57	55	69	62	62	67	55	70	61	56	67	57	55	56	57	69	58	65	57
PBX (%)	38	42	38	31	40	37	43	45	31	38	38	33	45	30	39	44	33	43	45	44	43	31	42	35	43

Variant 19

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	26	25	30	25	30	27	25	30	27	28	30	28	29	29	29	25	25	29	27	28	25	28	25	30	26
PS (%)	21	36	22	27	33	27	33	37	22	36	21	24	29	21	27	29	34	25	30	32	36	27	30	31	35
BS (%)	62	48	65	62	55	54	54	45	62	44	68	62	52	59	54	52	56	56	55	57	53	57	50	56	55
PBX (%)	17	16	13	11	12	19	13	18	16	20	11	14	19	20	19	19	10	19	15	11	11	16	20	13	10
Fax color (all %)	5	2	3	1	1	4	3	2	4	4	4	5	3	5	2	4	5	3	2	1	3	3	3	4	3
BS (%)	55	64	64	69	58	59	69	66	63	57	59	65	55	57	67	66	64	59	61	68	59	62	58	57	57
PBX (%)	45	36	36	31	42	41	31	34	37	43	41	35	45	43	33	34	36	41	39	32	41	38	42	43	43
Videotelephony (all %)	8	6	2	7	5	7	7	7	10	7	2	6	4	6	5	4	6	3	7	1	8	9	8	7	8
PS (%)	20	31	35	37	21	34	40	22	29	24	31	37	25	21	31	39	28	27	38	27	40	40	33	23	38
BS (%)	68	57	52	44	60	48	42	68	51	59	54	46	61	59	52	44	60	56	51	63	46	43	57	59	52
PBX (%)	12	12	13	19	19	18	18	10	20	17	15	17	14	20	17	17	12	17	11	10	14	17	10	18	10
Search video (all %)	20	15	15	16	20	16	16	18	16	18	20	16	15	18	20	16	16	19	15	19	19	17	20	18	18
PS (%)	8	8	2	1	10	10	3	3	1	1	4	3	1	10	3	2	10	9	1	10	7	6	8	7	4
BS (%)	41	41	47	53	48	47	42	47	52	52	47	51	45	46	50	43	38	36	51	45	38	47	41	43	48
PBX (%)	32	35	33	29	26	26	32	25	30	26	29	30	32	25	25	34	32	34	31	25	32	30	35	27	30
SC (%)	19	16	18	17	16	17	23	25	17	21	20	16	22	19	22	21	20	21	17	20	23	17	16	23	18
Documents Search (all %)	16	15	19	18	19	19	18	18	15	16	17	18	16	19	20	17	17	20	18	16	17	15	20	19	16
PS (%)	10	4	10	1	10	8	9	5	8	1	7	7	5	3	3	8	1	3	8	8	5	3	2	7	9
BS (%)	40	47	50	49	48	40	36	40	44	51	41	41	50	51	47	51	54	50	41	38	37	47	53	35	37
PBX (%)	33	27	25	31	25	32	33	30	27	25	29	28	27	28	34	25	26	29	26	31	34	29	29	35	31
SC (%)	17	22	15	19	17	20	22	25	21	23	23	24	18	18	16	16	19	18	25	23	24	21	16	23	23
Data transmission (all %)	25	37	31	33	25	27	31	25	28	27	27	27	33	23	24	34	31	26	31	35	28	28	24	22	29
BS (%)	60	55	69	67	61	62	67	55	55	63	58	69	60	58	60	61	58	63	56	64	67	62	61	60	70
PBX (%)	40	45	31	33	39	38	33	45	45	37	42	31	40	42	40	39	42	37	44	36	33	38	39	40	30

Variant 20

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	26	27	30	25	30	29	25	29	27	25	30	27	29	25	29	30	30	25	27	26	25	30	30	28	25
PS (%)	25	28	29	32	21	24	23	26	36	37	37	38	26	28	26	27	35	36	34	34	21	21	39	39	25
BS (%)	63	59	57	50	61	61	64	59	53	47	52	42	60	56	55	59	50	50	52	49	64	68	42	42	61
PBX (%)	12	13	14	18	18	15	13	15	11	16	11	20	14	16	19	14	15	14	14	17	15	11	19	19	14
Fax color (all %)	5	2	5	5	4	2	2	4	4	5	1	5	2	4	2	2	1	5	5	2	3	3	5	3	1
BS (%)	68	56	64	56	60	56	57	57	70	59	68	61	66	63	64	66	63	69	63	57	63	62	64	66	65
PBX (%)	32	44	36	44	40	44	43	43	30	41	32	39	34	37	36	34	37	31	37	43	37	38	36	34	35
Videotelephony (all %)	4	7	1	7	7	6	4	4	10	3	5	1	1	8	6	6	1	3	5	10	9	6	3	2	6
PS (%)	40	35	27	23	27	24	39	37	22	21	38	38	25	25	24	26	36	38	39	21	33	38	40	25	39
BS (%)	49	52	54	57	53	56	48	50	67	59	50	52	58	61	62	63	48	51	51	63	48	49	50	61	45
PBX (%)	11	13	19	20	20	20	13	13	11	20	12	10	17	14	14	11	16	11	10	16	19	13	10	14	16
Search video (all %)	16	20	19	20	19	17	16	17	17	16	15	18	17	17	17	20	20	20	15	18	19	20	15	19	15
PS (%)	2	4	2	9	7	8	6	2	10	1	9	5	2	3	10	6	3	4	1	6	3	3	10	5	1
BS (%)	57	50	53	47	44	49	50	43	41	56	35	51	46	50	42	44	41	44	45	37	44	47	48	39	46
PBX (%)	25	27	26	26	30	28	25	33	33	28	33	26	35	27	28	30	35	35	33	32	34	31	26	33	32
SC (%)	16	19	19	18	19	15	19	22	16	15	23	18	17	20	20	20	21	17	21	25	19	19	16	23	21
Documents Search (all %)	16	16	16	20	15	16	19	17	20	17	20	20	18	16	15	16	16	15	15	17	18	18	20	18	20
PS (%)	1	5	4	1	7	6	10	1	3	6	5	1	7	5	8	9	10	3	1	6	2	9	2	2	2
BS (%)	53	44	52	49	49	44	35	48	41	42	50	45	45	39	42	32	36	45	52	38	45	41	40	42	45
PBX (%)	28	29	28	25	25	29	30	30	32	27	30	33	26	35	29	34	30	30	27	34	33	35	35	33	34
SC (%)	18	22	16	25	19	21	25	21	24	25	15	21	22	21	21	25	24	22	20	22	20	15	23	23	19
Data transmission (all %)	33	28	29	23	25	30	34	29	22	34	29	29	33	30	31	26	32	32	33	27	26	23	27	30	33
BS (%)	55	61	66	66	59	70	66	57	56	58	60	58	63	56	64	68	64	63	62	57	59	65	70	55	64
PBX (%)	45	39	34	34	41	30	34	43	44	42	40	42	37	44	36	32	36	37	38	43	41	35	30	45	36

Variant 21

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	28	27	29	30	25	28	29	28	28	29	28	26	30	29	27	29	25	29	30	25	25	28	27	26	25
PS (%)	24	21	40	26	25	20	40	25	23	39	36	21	39	33	30	35	32	26	22	26	22	36	32	35	30
BS (%)	58	68	41	63	63	66	42	57	61	47	48	66	43	53	58	48	49	62	60	54	59	45	56	55	52
PBX (%)	18	11	19	11	12	14	18	18	16	14	16	13	18	14	12	17	19	12	18	20	19	19	12	10	18
Fax color (all %)	3	1	2	1	5	5	2	3	3	5	4	1	4	2	3	2	1	1	3	4	5	2	1	4	1
BS (%)	56	67	62	69	68	56	59	59	66	62	58	66	67	55	60	60	69	66	63	56	57	63	68	70	64
PBX (%)	44	33	38	31	32	44	41	41	34	38	42	34	33	45	40	40	31	34	37	44	43	37	32	30	36
Videotelephony (all %)	8	10	4	2	9	5	4	7	8	9	3	1	7	2	10	3	4	4	7	4	9	4	2	4	4
PS (%)	24	28	36	31	39	25	34	31	20	29	40	39	30	20	33	34	27	40	34	37	32	25	22	26	24
BS (%)	58	58	48	53	44	64	55	59	60	59	49	42	54	62	53	46	57	44	55	48	58	56	66	59	58
PBX (%)	18	14	16	16	17	11	11	10	20	12	11	19	16	18	14	20	16	16	11	15	10	19	12	15	18
Search video (all %)	16	18	16	18	20	17	16	18	15	18	17	20	17	15	15	19	16	20	15	19	17	16	17	16	15
PS (%)	1	7	2	8	8	4	8	4	4	9	3	9	8	3	7	2	1	6	10	4	3	8	1	5	3
BS (%)	48	39	41	47	38	49	41	46	47	38	49	45	35	45	36	51	41	52	42	47	47	36	47	40	52
PBX (%)	26	29	32	28	30	30	30	34	33	29	27	27	34	28	33	31	34	25	27	32	33	31	30	33	30
SC (%)	25	25	25	17	24	17	21	16	16	24	21	19	23	24	24	16	24	17	21	17	17	25	22	22	15
Documents Search (all %)	16	18	18	15	18	16	17	15	20	19	15	15	20	15	18	20	15	17	15	18	20	17	17	15	19
PS (%)	4	2	6	1	8	10	10	9	1	8	2	6	2	4	2	1	2	8	2	5	1	2	10	8	9
BS (%)	44	49	45	42	47	37	47	40	47	42	46	45	47	46	47	49	46	41	44	42	53	53	42	43	39
PBX (%)	28	30	31	34	30	34	27	32	31	27	33	29	31	29	26	25	29	29	29	30	26	28	30	34	32
SC (%)	24	19	18	23	15	19	16	19	21	23	19	20	20	21	25	25	23	22	25	23	20	17	18	15	20
Data transmission (all %)	29	26	31	34	23	29	32	29	26	20	33	37	22	37	27	27	39	29	30	30	24	33	36	35	36
BS (%)	60	56	64	63	66	68	67	56	66	59	63	59	59	59	70	57	63	69	70	64	60	57	65	65	68
PBX (%)	40	44	36	37	34	32	33	44	34	41	37	41	41	41	30	43	37	31	30	36	40	43	35	35	32

Variant 22

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	26	30	27	30	29	25	26	28	25	26	25	25	27	26	30	28	28	25	27	30	28	30	30	25	28
PS (%)	23	39	20	36	28	22	24	39	31	24	26	40	30	24	24	38	28	20	20	33	23	35	35	26	36
BS (%)	63	46	70	50	53	61	56	51	57	59	57	45	56	60	63	43	57	66	61	56	63	55	53	62	52
PBX (%)	14	15	10	14	19	17	20	10	12	17	17	15	14	16	13	19	15	14	19	11	14	10	12	12	12
Fax color (all %)	5	1	5	4	5	2	3	4	1	5	3	1	5	1	5	4	5	3	4	5	2	1	4	2	1
BS (%)	61	60	70	56	62	69	55	66	65	64	59	63	70	61	65	61	61	61	57	61	69	62	67	63	64
PBX (%)	39	40	30	44	38	31	45	34	35	36	41	37	30	39	35	39	39	39	43	39	31	38	33	37	36
Videotelephony (all %)	3	6	3	7	1	8	10	9	8	10	6	10	4	10	1	9	8	9	4	8	1	6	7	5	2
PS (%)	40	38	24	23	21	21	29	31	30	32	22	25	26	30	22	27	30	36	30	37	21	29	25	34	20
BS (%)	46	45	58	57	65	64	57	55	52	51	63	62	59	57	59	57	54	52	53	51	68	55	56	54	60
PBX (%)	14	17	18	20	14	15	14	14	18	17	15	13	15	13	19	16	16	12	17	12	11	16	19	12	20
Search video (all %)	20	16	15	20	20	17	17	16	17	20	20	15	16	19	20	15	17	20	16	18	20	18	15	17	19
PS (%)	8	1	5	3	7	10	3	1	5	7	1	8	1	3	6	3	6	8	1	8	10	2	5	1	3
BS (%)	50	50	44	54	43	42	46	45	43	43	56	46	43	42	46	45	42	42	54	42	40	49	51	49	46
PBX (%)	26	32	32	26	29	33	29	32	32	33	26	25	33	31	32	28	33	27	25	29	31	33	28	29	28
SC (%)	16	17	19	17	21	15	22	22	20	17	17	21	23	24	16	24	19	23	20	21	19	16	16	21	23
Documents Search (all %)	17	18	18	16	16	19	19	20	15	19	20	16	18	18	15	18	15	16	20	18	18	19	19	19	19
PS (%)	4	7	10	5	5	3	10	10	5	7	10	4	4	1	8	7	1	3	4	8	7	3	10	8	2
BS (%)	54	47	43	44	42	51	43	37	51	44	39	39	47	45	45	40	54	45	40	40	48	45	44	39	52
PBX (%)	26	31	26	26	34	30	27	30	29	27	27	32	34	34	26	33	26	29	34	33	28	33	30	31	28
SC (%)	16	15	21	25	19	16	20	23	15	22	24	25	15	20	21	20	19	23	22	19	17	19	16	22	18
Data transmission (all %)	29	29	32	23	29	29	25	23	34	20	26	33	30	26	29	26	27	27	29	21	31	26	25	32	31
BS (%)	55	70	60	70	63	68	65	65	65	61	64	55	61	63	57	55	67	60	60	64	68	67	57	68	62
PBX (%)	45	30	40	30	37	32	35	35	35	39	36	45	39	37	43	45	33	40	40	36	32	33	43	32	38

Variant 23

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	28	26	25	26	25	28	25	30	27	28	30	28	28	28	28	30	29	27	26	26	29	26	28	27	28
PS (%)	27	25	37	25	36	34	25	33	23	20	30	38	27	24	34	20	29	25	34	20	28	24	32	38	25
BS (%)	57	60	52	55	44	50	65	52	65	64	52	42	59	61	53	68	56	63	48	66	58	57	57	47	64
PBX (%)	16	15	11	20	20	16	10	15	12	16	18	20	14	15	13	12	15	12	18	14	14	19	11	15	11
Fax color (all %)	2	2	2	2	5	1	3	5	4	3	1	5	1	1	5	1	4	1	2	5	4	3	1	5	1
BS (%)	65	62	68	61	55	60	58	60	62	60	66	61	55	62	61	63	66	66	57	68	64	55	55	59	63
PBX (%)	35	38	32	39	45	40	42	40	38	40	34	39	45	38	39	37	34	34	43	32	36	45	45	41	37
Videotelephony (all %)	3	8	10	3	8	8	5	2	2	6	8	10	4	3	10	7	6	9	1	2	6	4	10	6	5
PS (%)	30	28	39	27	39	38	31	21	35	36	30	22	38	20	37	31	28	34	32	28	27	34	34	32	33
BS (%)	57	58	44	61	47	49	55	60	46	47	54	60	45	67	53	58	53	52	48	53	59	48	54	58	53
PBX (%)	13	14	17	12	14	13	14	19	19	17	16	18	17	13	10	11	19	14	20	19	14	18	12	10	14
Search video (all %)	18	15	18	15	15	18	15	19	19	17	15	19	20	19	17	16	17	16	15	20	16	16	15	15	18
PS (%)	4	7	3	5	6	8	3	5	6	7	3	4	4	6	1	2	2	3	8	8	8	9	3	4	3
BS (%)	45	46	54	40	38	40	49	45	42	44	40	47	44	45	52	48	45	46	42	50	45	46	41	47	54
PBX (%)	27	30	28	35	31	30	25	29	33	29	32	33	34	27	27	35	33	34	31	25	31	29	34	25	28
SC (%)	24	17	15	20	25	22	23	21	19	20	25	16	18	22	20	15	20	17	19	17	16	16	22	24	15
Documents Search (all %)	16	17	18	20	18	15	17	20	19	17	20	19	20	19	18	17	20	20	20	15	19	20	16	18	17
PS (%)	3	4	7	6	1	7	5	8	8	9	1	9	4	9	6	9	8	8	10	7	2	6	3	5	4
BS (%)	54	36	47	42	50	49	42	44	46	38	47	43	49	37	41	41	43	45	33	38	44	42	44	55	55
PBX (%)	25	35	28	28	27	28	34	25	27	31	28	33	26	32	32	28	34	32	34	33	30	30	35	25	25
SC (%)	18	25	18	24	22	16	19	23	19	22	24	15	21	22	21	22	15	15	23	22	24	22	18	15	16
Data transmission (all %)	33	32	27	34	29	30	35	24	29	29	26	19	27	30	22	29	24	27	36	32	26	31	30	29	31
BS (%)	67	64	65	66	62	66	57	64	66	61	59	56	65	66	70	58	58	65	60	70	60	58	59	60	57
PBX (%)	33	36	35	34	38	34	43	36	34	39	41	44	35	34	30	42	42	35	40	30	40	42	41	40	43

Variant 24

Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	30	27	27	26	25	26	25	28	26	25	28	29	25	29	30	30	30	26	26	30	28	29	26	29
PS (%)	20	28	33	40	34	20	25	31	25	31	35	20	34	40	22	27	40	25	27	32	23	28	30	34	25
BS (%)	66	58	52	41	48	65	63	56	65	54	45	62	55	47	63	63	49	65	53	56	67	56	57	54	57
PBX (%)	14	14	15	19	18	15	12	13	10	15	20	18	11	13	15	10	11	10	20	12	10	16	13	12	18
Fax color (all %)	1	1	2	5	2	4	1	1	5	3	2	4	4	4	5	3	5	2	5	5	3	2	1	3	3
BS (%)	63	55	68	64	57	58	63	68	69	62	59	57	67	68	58	64	66	61	59	58	68	55	62	69	56
PBX (%)	37	45	32	36	43	42	37	32	31	38	41	43	33	32	42	36	34	39	41	42	32	45	38	31	44
Videotelephony (all %)	8	9	9	2	10	6	1	9	1	1	1	4	1	6	1	8	10	9	8	10	7	1	5	2	3
PS (%)	21	23	23	26	37	20	22	27	40	25	28	35	29	37	22	31	27	37	23	34	32	23	33	25	25
BS (%)	63	58	62	57	45	61	64	59	47	62	56	50	59	53	66	49	58	51	65	48	56	60	51	55	63
PBX (%)	16	19	15	17	18	19	14	14	13	13	16	15	12	10	12	20	15	12	12	18	12	17	16	20	12
Search video (all %)	18	18	19	16	17	17	18	16	17	18	20	18	20	16	18	17	19	15	18	17	15	17	15	20	18
PS (%)	3	7	8	7	7	1	1	9	9	2	2	10	10	3	2	10	10	2	1	9	8	10	9	7	5
BS (%)	43	40	34	40	51	46	51	47	46	41	56	42	40	46	50	35	43	49	52	37	45	40	44	37	46
PBX (%)	34	35	34	34	26	35	31	28	28	34	27	31	28	31	32	33	27	27	25	34	25	33	27	33	32
SC (%)	20	18	24	19	16	18	17	16	17	23	15	17	22	20	16	22	20	22	22	20	22	17	20	23	17
Documents Search (all %)	20	16	20	20	19	17	16	17	17	16	16	19	20	15	16	20	17	18	15	15	18	16	20	15	19
PS (%)	3	4	1	4	8	4	5	4	2	3	9	2	5	1	1	9	7	7	2	5	7	2	2	9	7
BS (%)	47	45	48	43	41	42	43	41	54	51	44	48	44	56	45	33	34	41	44	37	45	45	53	41	52
PBX (%)	27	34	27	30	34	33	27	32	29	29	27	34	33	25	35	34	35	30	32	33	25	33	27	31	25
SC (%)	23	17	24	23	17	21	25	23	15	17	20	16	18	18	19	24	24	22	22	25	23	20	18	19	16
Data transmission (all %)	24	26	23	30	26	31	38	32	32	36	36	27	26	34	31	22	19	26	28	27	27	36	30	34	28
BS (%)	61	69	60	64	58	57	55	64	65	70	59	59	66	62	57	63	62	63	65	62	67	59	67	55	66
PBX (%)	39	31	40	36	42	43	45	36	35	30	41	41	34	38	43	37	38	37	35	38	33	41	33	45	34



Variant 25

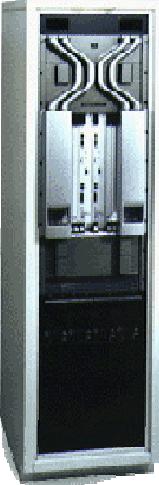
Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	29	30	27	27	26	25	26	25	28	26	25	28	29	25	29	30	30	30	26	26	30	28	29	26	29
PS (%)	20	28	33	40	34	20	25	31	25	31	35	20	34	40	22	27	40	25	27	32	23	28	30	34	25
BS (%)	66	58	52	41	48	65	63	56	65	54	45	62	55	47	63	63	49	65	53	56	67	56	57	54	57
PBX (%)	14	14	15	19	18	15	12	13	10	15	20	18	11	13	15	10	11	10	20	12	10	16	13	12	18
Fax color (all %)	1	1	2	5	2	4	1	1	5	3	2	4	4	4	5	3	5	2	5	5	3	2	1	3	3
BS (%)	63	55	68	64	57	58	63	68	69	62	59	57	67	68	58	64	66	61	59	58	68	55	62	69	56
PBX (%)	37	45	32	36	43	42	37	32	31	38	41	43	33	32	42	36	34	39	41	42	32	45	38	31	44
Videotelephony (all %)	8	9	9	2	10	6	1	9	1	1	1	4	1	6	1	8	10	9	8	10	7	1	5	2	3
PS (%)	21	23	23	26	37	20	22	27	40	25	28	35	29	37	22	31	27	37	23	34	32	23	33	25	25
BS (%)	63	58	62	57	45	61	64	59	47	62	56	50	59	53	66	49	58	51	65	48	56	60	51	55	63
PBX (%)	16	19	15	17	18	19	14	14	13	13	16	15	12	10	12	20	15	12	12	18	12	17	16	20	12
Search video (all %)	18	18	19	16	17	17	18	16	17	18	20	18	20	16	18	17	19	15	18	17	15	17	15	20	18
PS (%)	3	7	8	7	7	1	1	9	9	2	2	10	10	3	2	10	10	2	1	9	8	10	9	7	5
BS (%)	43	40	34	40	51	46	51	47	46	41	56	42	40	46	50	35	43	49	52	37	45	40	44	37	46
PBX (%)	34	35	34	34	26	35	31	28	28	34	27	31	28	31	32	33	27	27	25	34	25	33	27	33	32
SC (%)	20	18	24	19	16	18	17	16	17	23	15	17	22	20	16	22	20	22	22	20	22	17	20	23	17
Documents Search (all %)	20	16	20	20	19	17	16	17	17	16	16	19	20	15	16	20	17	18	15	15	18	16	20	15	19
PS (%)	3	4	1	4	8	4	5	4	2	3	9	2	5	1	1	9	7	7	2	5	7	2	2	9	7
BS (%)	47	45	48	43	41	42	43	41	54	51	44	48	44	56	45	33	34	41	44	37	45	45	53	41	52
PBX (%)	27	34	27	30	34	33	27	32	29	29	27	34	33	25	35	34	35	30	32	33	25	33	27	31	25
SC (%)	23	17	24	23	17	21	25	23	15	17	20	16	18	18	19	24	24	22	22	25	23	20	18	19	16
Data transmission (all %)	24	26	23	30	26	31	38	32	32	36	36	27	26	34	31	22	19	26	28	27	27	36	30	34	28
BS (%)	61	69	60	64	58	57	55	64	65	70	59	59	66	62	57	63	62	63	65	62	67	59	67	55	66
PBX (%)	39	31	40	36	42	43	45	36	35	30	41	41	34	38	43	37	38	37	35	38	33	41	33	45	34



Variant 26


Number object	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Telephony (all %)	25	29	26	29	27	30	25	26	29	30	29	29	30	29	27	25	30	27	29	26	30	25	26	26	29
PS (%)	37	37	23	22	40	39	24	23	40	38	23	21	37	34	40	37	32	28	33	30	24	20	24	20	34
BS (%)	53	53	61	58	47	51	63	63	45	42	57	61	47	48	46	43	53	58	48	60	63	60	66	70	56
PBX (%)	10	10	16	20	13	10	13	14	15	20	20	18	16	18	14	20	15	14	19	10	13	20	10	10	10
Fax color (all %)	5	3	1	3	1	2	1	5	5	2	3	3	5	4	1	4	2	3	2	1	1	4	5	5	2
BS (%)	57	60	59	65	60	55	62	62	65	69	68	60	56	68	60	60	65	69	70	63	59	56	66	67	56
PBX (%)	43	40	41	35	40	45	38	38	35	31	32	40	44	32	40	40	35	31	30	37	41	44	34	33	44
Videotelephony (all %)	7	6	10	2	4	8	7	3	9	8	1	2	3	7	5	1	6	4	7	8	8	1	8	3	8
PS (%)	25	31	23	30	34	21	37	24	31	40	37	26	35	25	24	36	26	39	40	33	25	40	22	38	31
BS (%)	59	49	67	57	46	68	52	64	52	43	47	59	47	58	63	53	62	41	45	56	64	43	68	46	55
PBX (%)	16	20	10	13	20	11	11	12	17	17	16	15	18	17	13	11	12	20	15	11	11	17	10	16	14
Search video (all %)	17	15	17	18	20	18	20	16	18	17	20	16	19	19	16	19	17	17	20	18	16	17	15	19	18
PS (%)	9	4	10	10	6	1	7	7	3	8	3	3	8	2	8	7	2	6	1	10	5	9	3	2	7
BS (%)	47	38	35	37	49	50	46	37	48	39	56	47	37	49	43	44	44	34	51	41	51	40	46	45	45
PBX (%)	28	35	33	28	30	34	30	32	31	32	25	34	31	28	29	25	30	35	32	25	26	29	34	35	33
SC (%)	16	23	22	25	15	15	17	24	18	21	16	16	24	21	20	24	24	25	16	24	18	22	17	18	15
Documents Search (all %)	18	16	18	20	16	16	19	16	20	15	19	17	17	19	19	18	19	16	18	18	20	19	16	18	15
PS (%)	6	6	6	8	6	1	5	2	4	4	3	5	2	6	10	6	8	7	5	6	3	6	9	5	6
BS (%)	45	47	39	38	43	49	48	50	40	40	44	52	46	41	49	52	51	40	43	51	54	49	46	47	46
PBX (%)	31	29	30	35	26	27	30	27	31	34	28	27	34	29	26	27	25	33	32	25	26	25	27	33	25
SC (%)	18	18	25	19	25	23	17	21	25	22	25	16	18	24	15	15	16	20	20	18	17	20	18	15	23
Data transmission (all %)	28	31	28	28	32	26	28	34	19	28	28	33	26	22	32	33	26	33	24	29	25	34	30	29	28
BS (%)	58	59	68	64	60	67	67	70	56	70	60	69	62	67	63	63	62	57	60	66	56	58	67	64	60
PBX (%)	42	41	32	36	40	33	33	30	44	30	40	31	38	33	37	37	38	43	40	34	44	42	33	36	40

Appendix C

Manufacturer\model	Interfaces	General capability	Characteristics
1	2	3	4
<p>FORE Systems ASX-200BX</p> 	<ul style="list-style-type: none"> - STM-1 - STM-4 - E1/ATM - E3/ATM - E1/CES - Frame Relay 	<ul style="list-style-type: none"> - Switching fabric 2,5 Gbit/s. - Complete support of NIUS of user ATM UNI v3.0/3.1/4.0. - Four network module slots. - Support of services of ATM Forum LANE (RFC1577). - Support of specifications: CBR, VBR, ABR - ER/EFICI, UBR. 	<p>Just over 4 inches high, a used ASX200BX features that supports up to 32 ports. It is compatible with the most extensive line of ATM interfaces in the industry, including T1/E1 through OC-12c/STM-4. In addition, it supports Frame Relay, Circuit Emulation (CEM), 10/100 and Gigabit Ethernet, and Inverse Multiplexing for ATM (IMA).</p>
<p>Cisco - BPX 8600</p> 	<ul style="list-style-type: none"> - OC-3/STM-1 - OC-12/STM-4 - DS3/E3 (45/34 Mbit/s) 	<ul style="list-style-type: none"> - Switching fabric 20 Gbit/s. - Configurable for trunk and public or private UNI application. - UNI conformant to ATM Forum UNI Specification V.3.1, ITU-T I.361 and I.432 specifications. - Support for ATM Forum ILMI 4.0. - Complies with standard Usage Parameter Control (UPC) per ATM Forum UNI Specification V.3.1, TM 4.0 and ITU-T I.371. - Supports virtual circuit connections (VCCs) and virtual path connections (VPCs) per ATM Forum UNI Specification V.3.1 and ITU-T I.371. - Virtual path identifier (VPI)/virtual channel identifier (VCI) range for VCCs and VPCs: per UNI Specification V.3.1. 	<p>The Cisco BPX 8600 Series Multiservice switches provide a scalable set of solutions to cost-effectively deliver ATM, Frame Relay, voice, circuit emulation and IP services in medium sized PoPs or small COs. High-scalability connection densities with up to 144 T3/E3 ATM ports on a single Cisco BPX[®] 8600 series wide-area switch. Complete network control through dynamic resource sharing and support for all ATM service classes. Industry's first fully compliant ATM Forum available bit rate (ABR) virtual source/virtual destination (VS/VD) capability in custom ASICs.</p>

1	2	3	4
<p>FORE Systems ASX-4000</p> 	<ul style="list-style-type: none"> <li>- Module 8 ports, STM - 4c, SC, multimode fiber; <li>- Module 8 ports, STM - 4c, single mode fiber, intermediate reach; <li>- Module of STM - 16c, single mode fiber; <li>- Module 2 ports of STM - 16c, single mode fiber; <li>- Module 2 ports of STM - 16c, 1559.0/1560.6nm, SMLR, SC; <li>- Module 2 ports of STM - 16c, 1555.8/1557.4nm, SMLR, SC; <li>- Module 4 ports of STM - 4c and 16 ports of STM - 1c, MM; <li>- Module 4 ports of STM - 4c and <li>16 ports 155Mbps STM - 1c, SMIR 	<ul style="list-style-type: none"> <li>- Switching fabric 10, 20, 30, or 40 Gbit/s non-blocking ATM via 1-4 switch modules. <li>- One 14-slot chassis with one integrated power supply shelf. <li>- 1 – 8 port card slots, 2 enabled per switch fabric. <li>- 4 AC or 5 DC power supplies, load-sharing, 1:N redundancy. <li>- AC Power Cables if applicable. <li>- Redundant Fan Trays. <li>- Filter Tray with Filter. <li>- One Pentium PRO switch control processor (256 Mbit/s DRAM). <li>- Support of specifications: CBR, VBR, ABR (with ER), UBR, UPC, Dual LB GCRA, CLP, EPD, PPD. 	<p>The Fore Systems ASX-4000 features a non-blocking switching fabric that scales from 10 to 40 Gbit/s on an in-service basis in 10 Gbps increments. First-to-market OC-48c ATM ports and high density OC-12c and OC-3c ports enable backbone trunking for networks whose edge and server connections are scaling from 10 Mbit/s, switched 10/100, 155 Mbit/s and 622 Mbit/s. Designed to support more than 1,000,000 VCs, the ASX-4000 provides advanced traffic management and signaling capabilities such as per - VC queuing, greater than 4,500,000 cell buffers, hierarchical PNNI, Distributed LAN Emulation, and MPOA. These features enable the backbone to support thousands of users, while maintaining a high quality of service – even under times of congestion. That’s the kind of scalability and capacity needed for serious ATM backbone networking.</p>

1	2	3	4
<p style="text-align: center;">Cisco 12000</p> 	<ul style="list-style-type: none"> - 1 port of ATM OC-12/ STM-4 - 4 ports of ATM OC-3/STM-1 - 1 port of POS OC-12/STM-4 - 4 ports of POS OC-3/STM-1 - 1 port of POS OC-48/STM-16 - 1 port channelized OC-12 to DS3 - 1 port Gigabit Ethernet 	<ul style="list-style-type: none"> - Switching Fabric: 30 Gbit/s. - Operating System: Cisco IOS. - Modular physical layer interface module (PLIM) front end that hosts up to two SPAs. - Dynamic allocation of 4096 input-shaped queues to any interface (or subinterface), Frame Relay connection, or VLAN. - High number of IPv4, IPv6, Multiprotocol Label Switching (MPLS), and MPLS VPN unicast and multicast routes: up to 1M IPv4/MPLS or 512,000 IPv6 route entries. - Multirouter automatic protection switching (MR-APS). - Layer 3 VPNs over MPLS and over IP. - Layer 2 VPNs over MPLS. 	<p>The Cisco 12000 router compose a portfolio of intelligent routing solutions that scale from 2.5 to nx10 Gbit/s capacity per slot, enabling carrier-class IP/Multiprotocol Label Switching (MPLS) networks and accelerating the evolution to IP Next-Generation Networks. Built upon a foundation of investment protection, this portfolio delivers up to 1.28 Tbit/s switching capacity with wire-speed feature performance, scalability, and graceful hardware and software upgrade paths.</p>
<p style="text-align: center;">3Com CELLplex 7200</p> 	<ul style="list-style-type: none"> - Module 2 ports of OC - 3c/STM - 1c; - Module 2 ports of DS3/E3; - Module 12 ports of Ethernet and 1 port of ATM OC - 3c/STM - 1c; - Module 12 ports of Ethernet and 1 port of ATM DS - 3/E3 	<ul style="list-style-type: none"> - Switching Fabric: 40 Gbit/s. - Establishment of the switching virtual channel (SVC) after the specifications of UNI 3.0 and 3.1. - Support of permanent virtual channel (PVC) by means of control system Interim Interswitch Signaling Protocol (IISP). - LAN of emulation. - Congestion management. 	<p>Combines the functions of ATM switching and Ethernet switching, simultaneously allowing to liquidate bottlenecks on the highway of network and in the networks of departments.</p>

1	2	3	4
<p style="text-align: center;">Cisco LightStream 1010</p> 	<ul style="list-style-type: none"> - 1 port of ATM OC 3c/STM - 1c; - 1 port of ATM OC 12c/STM - 4c; - 4 ports of ATM OC - 3c/STM - 1c; - 4 ports of ATM OC - 12c/STM - 4c; - 4 ports of ATM OC - 12c/STM - 4c (UTP Cat 5); - 2 ports of DS3/T3 45 Mb/s; - 2 ports of E3 34 Mb/s. 	<ul style="list-style-type: none"> - Switching Fabric: 5 Gbit/s to 40 Gbit/s. - Five-slot chassis (same dimensions as that of the Catalyst 5000) with ATM backplane and fan tray. - Optionally redundant, auto-sensing, load-sharing AC-input or DC-input power supplies. - The Cisco LightStream 1010 uses two management tools: AtmDirector and CiscoView. - Support of specifications: CBR, VBR, UBR, ABR - ER/EFCI. 	<p>The LightStream 1010 ATM is a Modular Switch that is designed for central intelligence with fully non-blocking switch fabric and the high performance RISC processor. Frontier offers used and refurbished Cisco LightStream 1010 ATM Switches.</p> <p>The central slot in the Cisco LightStream 1010 is dedicated to a single, field-replaceable ATM switch processor module (ASP) that supports both the 5 Gbit/s shared memory, fully nonblocking switch fabric, together with its feature card, and the high-performance RISC processor that provides the central intelligence for the device. Uniquely, the ASP module feature card can also be upgraded in the field, allowing the switch to track changing ATM specifications. The remaining slots support up to four hot-swappable carrier modules (CAMs), each of which, in turn, can support up to two hot-swappable port adapter modules (PAMs), for a maximum of eight PAMs per switch, supporting a wide variety of desktop, backbone, and wide-area ATM interfaces.</p>

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