Design and Specification for a Data Storage Centre for Bulgarian Schools

Best Practice Document

Produced by the BREN-led working group

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BREN is responsible for the contents of this document. The document was developed by the BREN working group.

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Table of Contents

Table of Figures

Executive Summary

Electronic education in Bulgaria, according to the National Strategy is based on four main pillars:

- Network infrastructure – (National backbone with "Last mile" to the institution (regional inspectorate of education, university, research institute, research laboratory, college, school etc.), extended with the local network of the institution.
- Storage infrastructure
- E-learning platform
- Digital educational content

Note: It is presumed by the National Strategy for ICT development to have one integrated network infrastructure for Education and Research for Bulgaria. The four pillars, taken in interoperability form the educational cloud for Bulgaria.

An important part of this integrated infrastructure for Education and Research for Bulgaria is a Centralised Datacenter, where we can concentrate and technologically refine three of the four pillars of the Bulgarian electronic education. These are the storage infrastructure and on it the E-learning platform with the digital content. Important part is the switch of the Datacentre to the National Network infrastructure.

We will try to answer the following questions:

- How to define the appropriate strategies to support e-learning in an educational & research institution.
- How to choose the appropriate storage and devices for the Centralised Datacentre to make it match for educational & research demanded technologies.
- How to technologically enhance education environment for e-learning, STEM or blended learning, making it maximally invincible from the local equipment.
- How to be up to date with the contemporary tendencies in ICT technologies utilization, reflecting modern pedagogies application.
- How to choose the appropriate Equipment for creating, operating and managing centralised storage as central part of a centralised Datacentre for the Bulgarian education.

1 Advantages of a Centralised Datacentre in Bulgarian education

- Educational content stored, maintained and retrieved at one place.
- Efficient use of resources
- Easier IP right implementation on content
- Effectiveness of spending
- Support of all type of educational activities and mixed educational programs
- Flexibility and rich functionalities
- High level of security
- Easier to implement multilingualism
- Advantage in maintenance and management
- Interoperability with existing institution (regional inspectorate of education, university, research institute, research laboratory, college, school etc.) management systems
- Centralised storage and maintenance of digital content

For these purposes in the document we share BREN's best practice views on the requirements for the Centralised Datacenter for Bulgarian Education

Assumption: The Education Data Center provides resources only to legitimate clients.

2 Basic elements of an educational datacentre

Specification of running Environments in the Centralised Datacenter

- Development.
- Testing.
- Staging.
- Production.
- Running day to day storage support.

Specification of the basic category of the host's functions (roles) of the servers in the Datacentre:

- Application Server (non-web).
- Database Server.
- SFTP server.
- Mail Server.
- Name Server.
- Configuration Management (puppet/ansible/etc.).
- Monitoring Server (nagios, sensu, etc.).
- Proxy/Load Balancer (software).
- SSH Jump/Bastion Host.
- Storage Server.
- Version Control Software Server (Git/SVN/CVS/etc.).
- Virtual Machine Manager.
- Storage arrays with management.
- Web Server.

Power supply and cooling of Datacenter:

- Power Usage Effectiveness of less than 1.3.
- Power connection of over 1 megawatt, Electricity connection of over 2 MW, connected to 10 kV power supply.
- Redundant transformers in separate rooms.
- 230 V and 400 V circuits available.
- Electricity consumption graphics can be downloaded in real time.
- Up to 30 kW for high-performance racks.
- Redundant, environmentally friendly USV facilities (Redundant, environmentally friendly UPS systems).
- Redundant transformers in separate rooms.
- High-performance diesel generator sets for up to 96 hours of autonomous operation.
- 104 kW cooling performance per conditioning cabinet.

- Cold/hot aisles with complete rack housing for large servers.
- 50 cm double floor height for optimal ventilation.

Tier of Datacenter: The Datacenter for education is to be minimum Tier 2 (better Tier 3) Datacenter, according to the four tier model of Datacenters.

REMOTE HANDS AND EYES for the Datacentre – engineers and technicians, ready to perform basic tasks on customer equipment under on-line customer supervision.

DISASTER RECOVERY SPACE – Private or shared office space for Disaster Recovery with direct cable connections to redundant IT equipment on site.

IP rights preserving scheme for the stored content

Encryption: concepts and roles if required encryption of data.

- Encrypted servers.
- Encrypted VoIP systems.
- Encrypted VPN connections.
- Encrypted end devices.
- Encrypted site connectivity.

Content Delivery Network (CDN) concept for Datacenter architecture. A CDN consists of a source server and several cache servers, to which users' queries are directed. If someone requests a particular file, the cache server checks to see if it is already available in the local cache. If so, it delivers it immediately. If not, it checks whether it is available in the global cache. If it is not available, it requests the file from the source server.

After analysing the situation, an individual CDN concept which takes into account the geographical distribution of the visitors is required.

3 Security

The goal is reliable protection against Distributed Denial of Service (DDoS) and Stream Control Transmission Protocol (SCTP) attacks.

3.1 DDoS

A Distributed Denial of Service[1] (DDS) attack uses more than one Zombie computer to launch a synchronised attack against the victim (it can be one or more target).Because of the client-server technology, attacker or executor is able to increase the success of the Denial of Service drastically by utilising the resources of multiple unaware zombie systems which serve as an attack enhancer.

3.2 SCTP

Stream Control Transmission Protocol (SCTP) is a new IP transport protocol, providing transport layer functionality to many internet applications; it exists at the same level of TCP (Transmission control protocol) and UDP (User datagram protocol). The establishment of SCTP connection:
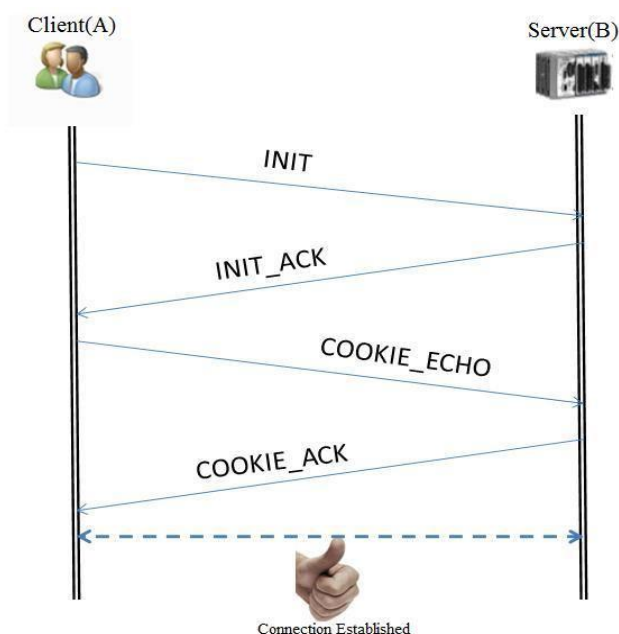
Figure 3.1: Stream Control Transmission Protocol

Varieties of DDoS and SCTP attacks are shown in Figure 3.2:

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[1] Definition of DDoS attacks by World Wide Web Security
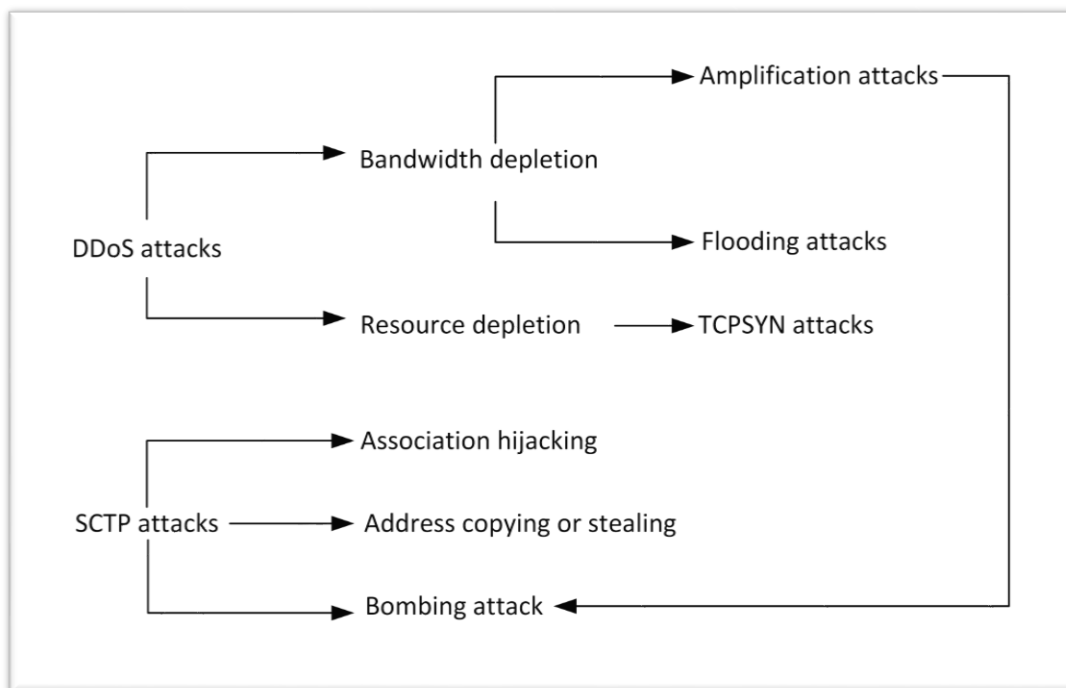
Figure 3.2: Types of DD0S and SCTP attacks
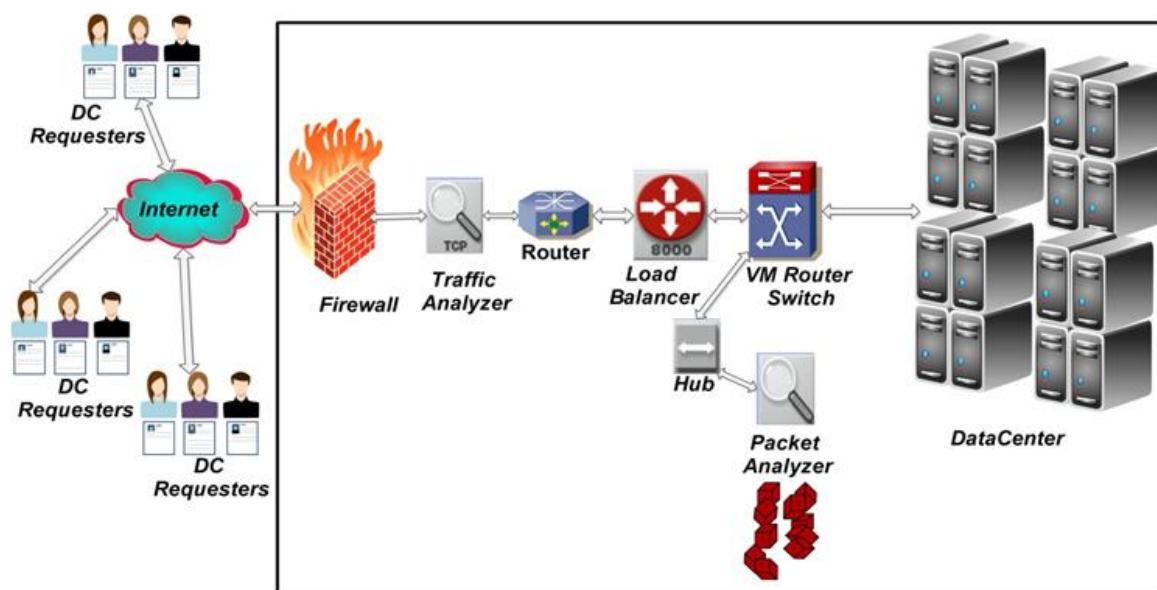
Figure 3.3: Proposed technological scheme for protection

3.3   The p-Filter concept

The p-Filter concept is based on the assumption that every server can serve a limited number of requests at a time. If the number of requests (invalid or valid) is within that range the server can work

efficiently and can serve those requests. The number of requests can be calculated on the basis of the available resources and the bandwidth allocated for particular server. Scheme:
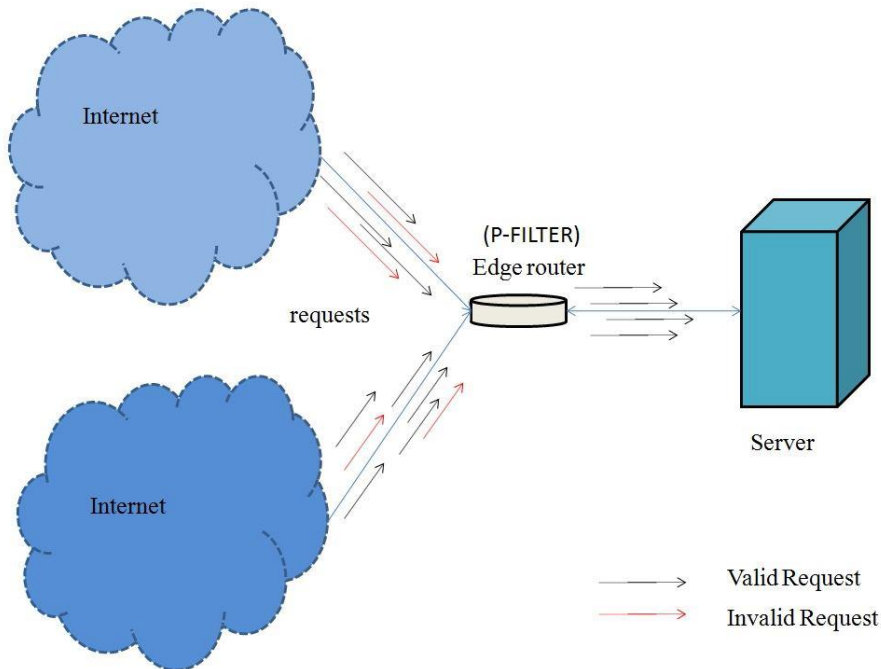
Figure 3.4: The p-Filter concept

The main purpose of this system is to balance the load of the system, which is the ultimate goal of every detection and prevention technique.

4 Storage Management

The management of safe, efficient and scalable storage is a key part in any Datacentre. The term storage management encompasses the technologies and processes that organisations use to maximise or improve the performance of their data storage resources. It's a broad category that includes virtualisation, replication, mirroring, security, compression, traffic analysis, process automation, storage provisioning and related techniques.

Storage management techniques can be applied to primary, backup or archived storage. Deployment and implementation procedures will vary widely depending on the type of storage management selected and the vendor. In addition, the skills and training of storage administrators and other personnel add another level to an organisation's storage management capabilities.

Storage Management gives the following benefits:

- Technologies – such as storage virtualisation, deduplication and compression – allow better utilisation of existing storage, resulting in lower costs for the operation and maintenance of storage devices. Management of storage networks and devices is simplified, reducing overall storage operating costs.
- Appropriate storage management improves a data centre's agility, resilience, performance, reliability and availability.
- Replication, mirroring and security are often particularly important for backup and archive storage.

The primary organisation involved in establishing storage management standards is the Storage Networking Industry Association (SNIA). It has proposed several important storage specifications, including the Storage Management Initiative Specification (SMI-S) and the Cloud Data Management Interface (CDMI). Storage management is also closely associated with networked storage solutions, such as Storage Area Networks (SANs) and Network-Attached Storage (NAS) devices.

5 Specification of Main Components

5.1 General Requirements

✓ The equipment should be proposed by manufacturers using a certified quality management in accordance with the requirements of ISO 9001:2008 or an equivalent standard. This should be verified with a certified copy of the certificate. If the participants in the procedure submit documents in a language other than Bulgarian the documents should be presented with Bulgarian translation.

✓ The devices should comply with all approved standards concerning technical exploitation, fire safety, safety regulations and connection to the grid.

✓ Complete detailed documentation in Bulgarian or English (on paper or in electronic format), including a description of the hardware functionality and software documentation should be included with the device.

✓ All proposed devices should be new, unused and should be included in the product list of the respective manufacturer.

✓ All proposed devices should be supplied with the necessary hardware, modules, cables (including power cables), software licenses, etc., so that they can operate and perform the functions listed in the specification.

✓ The proposal shall include explanatory materials, including a brief description of the basic technical characteristics as per the specification. These materials should clearly indicate the main technical parameters on the basis of which the device will be assessed.

6 Supply of data storage systems

The lot includes delivery, installation and commissioning of:

- Disk array type 1 (storage).
- Disk array type 2 (storage) disk arrays .
- Tape library for archiving.

6.1 Disk array type 1 (storage)

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and disk array brand:	To be specified; By a manufacturer that has an official service center in Bulgaria	
2.	Series and model of the disk array:	To be specified	
3.	Connection protocol:	Available FC 8Gb, Support for iSCSI 1 / 10Gb, FCoE 10Gb	
4.	Licenses:	Snapshots license incl.	
5.	Controllers:	2 Mutual security controllers; Minimum controller cache: 2GB (total 4GB); Data protection in memory in case of power failure	
6.	Number of ports:	4x 8Gb FC	
7.	Installed drives:	Min 7h2TB 7.2 3.5 "NLSAS; Support for SAS 6Gb and SSD	
8.	Usable capacity:	Min 10,5 TB usable formatted space after RAID 5	
9.	LUN capacity:	Min 16TB	
10.	Number of supported hosts:	Min 512	
11.	Number of supported drives:	Min 120 pcs. with form factor upon initial installation	
12.	Supported Raid levels:	1, 5, 6, 10	
13.	Installation:	Possibility of rack-mounting	
14.	Warranty:	Minimum 3 years, 24 x 7 mode, response time: up to 8 hours	
15.	System functionalities included in the proposed configuration:	Include on-line migration feature of LUN between different RAID groups in order to maintain system capacity; To be delivered with the necessary resources for monitoring and configuration through the GUI and CLI.	

16.	Scalability – LUN provisioning:	Possibility of Dynamic LUN Provisioning (Dynamic Thin Provisioning)	
17.	Delivery time:	Within 45 days of signing the contract	
18.	Deadline for installation:	Within 10 days of the Contracting Authority's request	
19.	Compliance:	CE, IT ECO Declaration, RoHS or equivalent	

6.2   Disk array type 2 (storage) disk arrays

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand of the disk array:	To be specified; By a manufacturer with an official service center in Bulgaria	
2.	Series and model of the disk array:	To be specified	
3.	Architecture:	Architecture with duplicated components without a single point of failure. Possibility for replacement/ upgrade of each component without interruption of operation	
4.	Possibility of extension:	Possibility for gradual extension without interruption of operation of the hard drives, controllers, connection modules (Channel controllers), back-end modules (disk controllers).	
5.	Controllers of the proposed configuration:	Duplicated architecture with automatic balancing of the work load and dynamic allocation of input-output requests between the system components; Possibility of upgrade to at least 8 controllers within the system	
6.	Controllers–interface for the hosts (Front End) of the proposed configuration:	The system should have at least eight 8 FC ports 8 Gbps for connecting to the data network (SAN) with possibility to expand to at least 128 ports	
7.	Controllers-interface for the drives(Back End)of the proposed configuration:	4 Gbps Fiber Channel or 6 Gbps SAS	
8.	Controllers – Cache memory of the proposed configuration:	Minimum 2 controllers; Minimum 256 GB installed cache memory, net usable disc reading and recording capacity	

		(Data Cache*); The cache disk reading and recording capacity should be expandable to at least 512 GB for the entire system	
9.	Protection of the cache memory from a power failure of the proposed configuration:	Built-in functionality for storage of the cache memory on flash memory or disk in the event of power failure	
10.	Protocols supported by the system:	FC, FCoE, iSCSI	
11.	Bandwidth between the controllers and the system hosts (Front-end aggregate bandwidth):	Minimum 1,024 Gbps for the entire system for the optimal configuration	
12.	RAID levels of data protection for the proposed configuration:	Minimum support for 5, 6 and 10 RAID levels	
13.	Disk interfaces supported by the proposed configuration:	Minimum support for FC / SAS and SATA / NL-SAS interfaces; All discs should be with dual-port interfaces	
14.	Disk types supported by the proposed configuration:	The proposed configuration should support FC / SAS, SATA / NL-SAS and Solid State drives within one system; The discs should be replaceable during the operation (hot swap); The proposed configuration should support at least the following types of discs; 600GB FC / SAS,15000 rpm; 1 TB SATA / NL-SAS,7200 rpm; 2 TB SATA / NL-SAS,7200 rpm; SSD.	
15.	Number of disks for maximum number of expansion chassis installed:	The system should support expansion to a minimum of 1900 disks	
16.	Maximum usable internal capacity of 15 KRPM disks for the maximum number of expansion chassis installed:	Minimum 900 TB RAW; The type and size of discs should be indicated	
17.	Disks in the proposed configuration:	The proposed configuration should contain no less than 88 discs; The proposed disks should be identical – 600 GB15,000 rpm FC 4Gb or SAS 6Gb	
18.	Disk redundancy in the proposed configuration:	The system should have at least 8 additional disks as hot spare	
19.	Capacity of the proposed configuration:	Minimum 41 TB of usable disk space, formatted capacity after RAID- 5 7 +1;	

		The proposed usable volume of formatted capacity per each group after RAID-5 7 +1 should be indicated	
20.	System functionalities included in the proposed configuration:	Minimum functions: Dynamic expansion of the available space, dynamic change of the RAID levels, dynamic change of the copy functions, dynamic change of the information blocks; Possibility of online LUN migration between different RAID groups without interruption of the operations; The license should cover the maximum capacity supported by the system; Possibility of configuring the Quality of Service. The included license should be for the maximum supported capacity and number of hosts in the system; Possibility of creating local data copies on LUN by cloning and snapshot. The included license should cover the maximum capacity supported by the system Possibility of performing storage-based replication. The proposed disk subsystem should include an option for distant synchronous and asynchronous data replication; Concurrent synchronous and asynchronous replication with the possibility of data redundancy between at least three locations. The included license should cover the maximum capacity supported by the system.	
21.	Scalability possibilities – software:	Possibility of adding software to monitor the workload and resources of the disk array with an option to make past references and monitor trends	
22.	Scalability possibilities- LUN provisioning, Auto Tiering:	Possibility of Dynamic / Thin Provisioning; Possibility of automatically deploying "hot" data on faster media (Auto Tiering).	
23.	Supported size of one logical unit (LUN):	Minimum 16 TB	
24.	Maximum number of supported logical units (LUN / Volume):	Minimum 10,000	
25.	Included number of licenses for the host groups/ partitions of the proposed configuration:	The maximum supported number for the system	

26.	Support for LUN security features:	To be specified for the proposed configuration	
27.	Supported operating systems:	Minimum: Microsoft Windows Server 2012, Windows Server 2008, Linux, IBM AIX, Oracle Solaris, VMware ESX, Microsoft Hyper-V	
28.	Management and Monitoring:	Software for remote and local management and monitoring with GUI / Web and CLI user interface included. The software should allow for minimum configuration of logical partitions, hosts, RAID levels and access to hosts	
29.	Licenses and software for hosts multipath	Included licenses for drivers for hosts multipath	
30.	Self-diagnostics of the proposed configuration:	Functionality for automatic self-diagnostics including detection and isolation of defective modules	
31.	Software licenses included in the proposed configuration (functional, for controlled disk space, host groups, partitions, host operating systems, etc.):	To be specified in detail with product numbers and descriptions	
32.	Form factor:	The disc system should be delivered with appropriate rack(s) provided by the manufacturer	
33.	Configuration of power supply blocks:	Redundant N + 1, replaceable during machine operation	
34.	Cooling system:	Reticent, with automatic thermal control speed, replaceable during machine operation	
35.	Cables:	All the necessary optical cables for redundant connection to each of the system's controllers in SAN environment; All required network cables for connection to the LAN; All required cables for connection to the power supply	
36.	Warranty Support by the Manufacturer:	Minimum 3 years warranty on the hardware and software; Minimum support – by telephone and over the Internet 24x7x365; Response time: within 4 hours of reporting a problem	

	Parameter	Parameter requirement	Participant's proposal
37.	Support by the supplier / representative for Bulgaria:	24x7x365 support for minimum 3 years, spare parts and manpower, including provision of the latest driver software, system software and management software; Minimum support – by telephone, over the Internet and on the client's premises; Response time: within 4 hours of reporting a problem	
38.	Reaction time for replacing a defective part by the supplier within the warranty period:	Within 5 working days of receipt of the request	
39.	Delivery time:	Within 45 days of signing the contract	
40.	Deadline for installation:	Within 10 days of the contracting authority's request	
41.	Compliance:	CE, IT ECO Declaration, RoHS, or equivalent	

* Data Cache –accounts for a net capacity of the used cache for disk reading and writing operations. Does not include management memory, additional redundancy capacity.

6.3   Tape library for archiving

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand:	To be specified; By a manufacturer with an official service center in Bulgaria	
2.	Series and model:	To be specified	
3.	Maximum number of backup devices:	Max 2	
4.	Installed backup devices:	1 backup device	
5.	Type of storage device:	LTO Utrium 5	
6.	Tape cartridge capacity:	Minimum 1.5 TB uncompressed (native)	
7.	Type of interface for data transfer:	Fiber Channel interface	
8.	Speed of interface for data transfer:	Minimum 8Gb / s	
9.	Data transfer speed:	Minimum 140 MBps without data compression	

10.	Number of tapes of the device:	Min 8 capacity: - Without compression – up to 1.5TB with LTO 5; - With compression – up to 3TB with LTO 5;	
11.	Information storage carrier included in this set:	Minimum 20 pieces – 1.5TB / 3TB LTO 5 psc.	
12.	Cleaning carriers included in this set:	Minimum 1 pcs.	
13.	Type of case / chassis:	For direct mounting in 19 "Rack	
14.	Size of the case / chassis:	Maximum 2U	
15.	Warranty:	At least 3 years, response time: up to 8 hours	
16.	Delivery time:	Within 45 days of signing the contract	
17.	Deadline for installation:	Within 10 days of the Contracting Authority's request	
18.	Compliance:	CE, IT ECO Declaration, RoHS	

7 Supply of video conferencing equipment, displays and IP surveillance cameras

The lot includes delivery, installation and commissioning of:

- A video conferencing system.
- IP cameras PTZ for surveillance and monitoring.
- Displays for process visualisation.

7.1 Video conferencing system

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand of the video conferencing system:	To be specified	
2.	Series and model of the video conferencing system:	To be specified	
3.	Equipment:	2 cameras, codec device, device for positioning the camera towards the speaker, 3 microphones, 2 displays, remote control, all necessary cables and accessories that make it fully functional	
4.	Supported standards and protocols:	The system should support the following standards and protocols: H.264, H.263 ++, H.261, H.239, H.263 & H.264	
5.	Resolutions for video conference connection:	720p at 60 frames / second 4SIF / 4CIF at 60 frames / second SIF (352x240), CIF (352x288) QSIF (176x120), QCIF (176x144) The system should allow conducting a video conference with a resolution HD (1280x720p), bandwidth 512Mbps	
6.	Resolution for shared content:	HD (1920 x 1080) WSXGA+ (1680 x 1050) SXGA (1280x 1024) HD (1280 x 720) XGA (1024 x 768), SVGA (800 x 600) VGA (640 x 480)	

| 7. | Requirements for the codec device: | Video inputs:
• Min 2 x HD video inputs for cameras, Min. 1 x S-Video, Min. 1 x DVI-I
Video outputs:
• Min 2 x DVI-I HD video outputs,
• Min 1 x S-Video
Audio inputs:
• Min 3x microphones with a bandwidth of 22kHz; Min 1x Line-level stereo in (RCA); Min 1x 3.5mm stereo mini (PC Audio); Min. 1 x 1 x VCR / DVD stereo audio-in (RCA)
Audio Output
• Min. 1 x stereo output (RCA); Min 1xVCR / DVD stereo audio-out (RCA)
To provide audio with bandwidth 22kHz
To support audio standards: G.722, G.722.1, G.711, G.728, G.729A
To support standards: H.221, H224 / H.281, H.323 Annex Q, H.225, H.245, H.241, H.331, H.239, H.231, H.243, H. 460, BONDING, Mode 1, BFCP (RFC 4562), TIP
To have Min 1x 10/100 Ethernet RJ 45 interface;
To support technology that allows for loss of 5% of the packages without any significant change in the quality of the ongoing video conference session;
To have 1x RS232 interface;
To allow camera control from a distant country;
To have Min 1x interface for an analog phone;
To support integration with Microsoft® Office Communications Server, Microsoft® Lync ™;
To have a web-based management interface;
Possibility of adding 4 BRI interfaces by adding an additional module;
To support the possibility of updating the system software via the USB interface;
To support encryption using AES FIPS 197, H.235V3 and H.233 / 234;
To support IPv6 | |
| 8. | Requirements for the speaker monitoring device: | Fully automated to position one of the cameras in the direction of the sound and to focus on the speaker;
To implement automated voice triangulation and cropping of the image of the speaker;
To control the camera, so as to monitor the movements of the speaker;
To shift the focus automatically on the new speaker if another person begins to speak; | |

		To have Min 1x HD video output; To have Min 1x USB interface for diagnostic purposes; To have a stereo audio connector	
9.	Cameras – 2 pcs.:	To support 1920h1080r resolution at 60 frames / second; To have Min 12x optical zoom; To have Min 72 ° visual field; To operate in illumination of 50 lux, SNR 50dB	
10.	Microphones – 3 pcs.:	To support 22kHz stereo technology; To have 3 active elements	
11.	Displays – 2 pcs.:	Screen Size: Min 55 "; Display Type: LED; Resolution: HD; To have an HDMI interface; To support Wi-Fi communication Equipment – interface DVI-D (M) at codec to HDMI (M) 3m and power cords	
12.	Warranty support:	3 years, with replacement of defective components	
13.	Delivery time:	Within 45 days of signing the contract	
14.	Deadline for installation:	Within 15 days of the Contracting authority's request	

7.2   IP cameras PTZ for surveillance and monitoring

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand of the IP cameras:	To be specified	
2.	Series and model of the IP cameras:	To be specified	
3.	Network interface:	Integrated 10/100 Ethernet	
4.	Optical zoom:	Min 20x, autofocus	
5.	Matrix:	1/3'' CMOS	
6.	Megapixels:	2	

7.	System:	NTSC/PAL	
8.	Min illumination:	1 lux@F1.5	
9.	Memory card:	microSD / SDHC	
10.	Picture compression:	H.264/M-JPEG	
11.	Resolution:	1920 x 1080, 1280 x 720, 1024 x 768, 640 x 480, 320 x 240	
12.	Shots in streaming video:	1~25fps	
13.	Focus management:	Auto, manual	
14.	Night mode:	Support	
15.	Wide Dynamic Range:	Support	
16.	Dynamic noise reduction:	Support	
17.	White Balance:	Support with automatic settings	
18.	Movement monitoring:	Support, 4 zones	
19.	Zone customisation:	Support, 4 zones	
20.	Audio communication:	Two-way	
21.	Sound compression:	Min G.711	
22.	Audio input / output:	3,5 mm phone jack	
23.	Speed of the horizontal rotation:	0,01º/sec – 360 º /sec	
24.	Manual control of Pan / Tilt speed:	0,01º/sec – 180 º /sec	
25.	Positioning accuracy:	0,1º	
26.	Scope of the horizontal rotation:	360 º	
27.	Tilt range:	90 º	
28.	Auto Speed Control:	Support	
29.	Auto Pan Speed:	0,01º/sec – 360º /sec	
30.	Saved positions	Min 100	
31.	Time to reach a certain position:	0,01º/sec – 360º /sec	

32.	Cruise path:	Min 10 groups	
33.	Number of preset positions per group:	16 positions	
34.	Supported protocols:	HTTP, TCP / IP, FTP, SMTP, DHCP, DNS, DDNS, NTP	
35.	Bandwidth Control:	Min. 64 kbps adjustable	
36.	Alarm:	Support at occurrence of specific event / events	
37.	Power consumption:	Max 40W	
38.	Certificates:	CE, FCC	
39.	Automatic recovery after recovery of power supply:	Support	
40.	Possibility of installation on a wall / ceiling:	Support	
41.	Delivery time:	Within 30 days of signing the contract	

7.3 Displays for process visualisation

	Parameter	**Parameter requirement**	**Participant's proposal**
1.	Manufacturer and brand of the displays:	To be specified	
2.	Series and model of the displays:	To be specified	
3.	Diagonal measurement of the visible part:	102 cm (40 inches)	
4.	Thickness, Weight:	Up to 3 cm Up to 11 kg	
5.	Brightness:	350 cd/m2	
6.	Power consumption:	Up to100W	
7.	Contrast (static, dynamic):	5000:1, 100000:1	
8.	Viewing angle (horizontal, vertical):	178 ° 178 °	

9.	Backlight:	LED	
10.	Number of supported colours:	16,7 million colours	
11.	Resolution:	1920x1080	
12.	Response time:	Up to 8 ms	
13.	Progressive scan:	Support	
14.	Image Aspect Ratio:	16:9	
15.	Audio system – stereo:	Built-in – min. 2 10W speakers	
16.	Built-in media player and supported formats:	For sound: AAC, ADPCM, HE-AAC, LPCM, MP3, WMA For images: JPEG For video: ASF, AVI, DivX, H.264, MKV, Motion-JPEG, MPEG-1, MPEG-2, MPEG-4, TS, VC-1, VOB	
17.	Interfaces:	HDMI Component video input Audio line-in DVI-D input VGA input Stereo line-out RS232C (in/out) RJ-45 USB Display Port DVI-D output IR/Ambient sensor	
18.	TV Tuner:	Optional element	
19.	Ecological standards:	ENERGY STAR 5.0 Qualified	
20.	Equipment:	Remote control, a manual in Bulgarian language, power (BG) and interface cables (VGA, HDMI)	
21.	Warranty:		
22.	Delivery time:		

8 Delivery of workstations and tablets for monitoring and management

The lot includes the supply of Workstations.

8.1 Workstations

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand of the workstation:	To be specified	
2.	Series and model of the workstation:	To be specified	
3.	Case and dimensions:	Integrated all-in-one desktop device with built-in display components	
4.	Processor:	Quad, Min 3.4GHz Min 4 MB cache (Intel Core i7 or equivalent)	
5.	RAM:	Min 16 GB DDR3, 1600 MHz	
6.	Hard drive:	Min 1TB combined hard drive with 128MB SSD carrier where frequently accessed data will be automatically transferred for faster access	
7.	Video controller:	Graphics processor with Min 2GB DDR5 own memory, with simultaneous support of additional built-in display and an external monitor with 2560 x1600 resolution	
8.	Audio/Video:	Integrated with built-in speakers and a built-in double microphone, built into the body of the HD camera for video calls and recording	
9.	Input/ Output ports:	Combined audio port: 4 x USB 2.0 ports 2x Thunderbolt or equivalent ports for connecting external devices with transfer speed 10Gbps SD card slot 10/100/1000 Ethernet port	

10.	Communication modules:	Support for 802.11n Wi-Fi connectivity, compatible with standards IEEE 802.11a / b / g built-in Bluetooth	
11.	Mouse:	Bluetooth mouse with multitouch control	
12.	Keyboard:	Bluetooth keyboard with Cyrillic layout -BDS (Bulgarian State/National Standard) without a separate numeric keypad	
13.	Display:	Min 27 "IPS LED backlit display, 2560x1440 resolution	
14.	Equipment:	Power cable for the device, instructions in Bulgarian language	
15.	Software:	The workstations should be compatible with OS X 10.8 or higher version and Windows 7 or higher version; and the device should be delivered with an installed operating system included in the price	
16.	Warranty period:	12 months on the client's premises	
17.	Delivery time:	Within 45 days of signing the contract	

9 Delivery of servers

The lot includes delivery, installation and commissioning of:

- Database servers – type 1.
- Application servers – type 2.
- Backup servers.

9.1 Database servers – type 1

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand:	To be specified; By a manufacturer with an official service center in Bulgaria	
2.	Series and model:	To be specified	
3.	Processors installed:	Minimum 2 processors, eight nuclear x2 threads (16 threads per socket) with a frequency of> = 2 GHz, with a minimum of 18MB cache; Support for Virtualisation Technology (Intel Xeon E7 series or equivalent) and Min 4 processors	
4.	Installed memory:	Minimum 192 GB DDR3-10600, 1333MHz, RDIMM, ECC modules	
5.	Maximum supported memory:	Minimum 2048 GB	
6.	Hard discs:	Minimum 8 2.5 "SAS Hot-Swap HDDs with installed 8 X 300 GB 6G SAS 10K rpm	
7.	Data storage controller (internally):	Minimum 1 PCIe 6Gbps SAS, Minimum RAID 0,1,5,6,10,50,60, cache size -minimum 512MB DDR2; Possibility to work with SSD drives	
8.	Data storage controller (externally):	Minimum of 2 Single-Port PCI-E 8Gbps Fiber Channel Adapters	
9.	Type of the chassis:	For mounting in 19 "Rack, with telescopic rails included in the kit	
10.	Size of the chassis (RU):	Up to 4U	

11.	Power supply:	Minimum 2 redundant power modules with a minimum of 92% efficiency; Power supplies must operate at a load balancing mode;	
12.	Cooling:	Redundant fans with automatic thermal control; Suction of cold air through the front panel, release of hot air out through the back panel	
13.	Replacement of defective modules during operation without stopping the server (Hot-Swap):	Power supply blocks, fans, and hard drives	
14.	Optical devices:	Without optical device installed	
15.	Total expansion slots (built-in without an external module):	Min 7 units PCI-E 2.0	
16.	Network adapters / ports:	Minimum 4 adapters (ports), type Ethernet 10/100/1000-Base-T Full Duplex; with support of Wake-On-LAN, PXE 2.0, TOE (TCP / IP Off Loading Engine);	
17.	Module for remote diagnostics and administration:	Support for IPMI 2.0 or equivalent technology for Side-Band management; Separate independent 10/100 Base-T Ethernet System Management Port allowing Out-of-Band management; Remote Desktop / Presence (Text & Graphic Console) Virtual optical drives support; Integration with external LDAP for centralised authentication; SSL support for encryption of the management traffic;	
18.	Service chip for monitoring of the operational parameters:	Chassis temperature, CPU temperature, status of all fans, voltage of all internal power lines, status of power supplies	
19.	Supported operating systems:	Min: Microsoft Windows 2008/2012 Linux	
20.	BIOS:	Unified Extensible Firmware Interface (UEFI) Support	
21.	Security modules:	Trusted Platform Module (TPM 1.2)	

	Parameter	Parameter requirement	Participant's proposal
22.	Warranty:	At least 3 years on-site mode 24x7; Response time: up to 4 hours	
23.	Delivery time:	Within 45 days of signing the contract	
24.	Compliance:	CE, IT ECO Declaration, RoHS	

9.2   Application servers – type 2

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand:	To be specified; By a manufacturer with an official service center in Bulgaria	
2.	Series and model:	To be specified	
3.	Installed processors:	Minimum 2 CPU six-core processors with a frequency> = 2 GHz, with a minimum of 15 MB cache, Virtualisation Technology (Intel Xeon E5 series or equivalent) support	
4.	Installed memory:	Minimum 128GB DDR3-10600, 1333MHz, RDIMM, ECC modules	
5.	Maximum supported memory:	Minimum 768 GB	
6.	Hard drives:	Minimum 8 units 2.5" SAS Hot-Swap HDD slots with installed 8 X 300 GB 6G SAS 10K rpm	
7.	Data storage controller (internally):	Minimum 1 PCIe 6Gbps SAS, Minimum RAID 0,1,5,6,10,50,60, cache size Minimum 512MB DDR2, with the possibility of working with SSD drives	
8.	Data storage controller (externally):	Minimum 2 Single-Port PCI-E 8Gbps Fiber Channel Adapters	
9.	Type of the chassis:	For mounting on a standard 19 " Rack, with telescopic rails included in the kit	
10.	Size of the chassis (RU):	Up to 2U	

11.	Power supply:	Minimum 2 redundant power modules with a minimum of 92% efficiency; Power supplies must operate at load balancing mode;	
12.	Cooling:	Redundant fans with automatic thermal control; Suction of cold air through the front panel, releasing hot air out through the back panel	
13.	Replacement of defective modules during operation without stopping the server (Hot-Swap):	Power supply blocks, fans, and hard drives	
14.	Optical devices:	Without optical device installed	
15.	Total expansion slots (built-in without an external module):	Minimum 4 PCI-E 2.0 8x	
16.	Network adapters/ports:	4 minimum adapters (ports), type Ethernet 10/100/1000-Base-T Full Duplex; with Wake-On-LAN, PXE 2.0, TOE (TCP / IP Off Loading Engine) support	
17.	Module for remote diagnostics and administration:	Support IPMI 2.0 or equivalent technology Side-Band management; Separate independent 10 / 100Base-T Ethernet System Management Port allowing Out-of-Band management; Remote Desktop / Presence (Text & Graphic Console) Virtual optical drives Support; Integration with external LDAP for centralised authentication; SSL support for encryption of the management traffic;	
18.	Service chip for monitoring of the operating parameters:	Chassis temperature, CPU temperature, status of all fans, voltage of all internal power lines, status of power supply blocks	
19.	Support for operating systems:	Minimum: Microsoft Windows 2008/2012 Linux	
20.	Security modules:	Trusted Platform Module (TPM 1.2)	
21.	Warranty:	At least 3 years on-site – 24x7, Response time: up to 4 hours	

	Parameter	Parameter requirement	Participant's proposal
22.	Delivery time:	Within 45 days of signing the contract	
23.	Compliance:	CE, IT ECO Declaration, RoHS	

9.3 Backup servers

	Parameter	Parameter requirement	Participant's proposal
1.	Manufacturer and brand:	To be specified; By a manufacturer with an official service center in Bulgaria	
2.	Series and model:	To be specified	
3.	Installed processors:	Minimum 1 processor with a minimum of four cores with frequency> = 2.0GHz, with virtualisation technology support	
4.	Maximum number of processors:	Minimum – 2 four-nuclear processors	
5.	Installed memory:	Minimum – 16 GB DDR3-10600 1333MHz ECC modules	
6.	Maximum supported memory:	With the possibility of expansion to minimum 768 GB	
7.	Hard drives:	Minimum 2, with a capacity of at least 250GB (for an operating system) Minimum 10, with a capacity of at least 2000 GB each (for archiving); Possibility of installing / removing the disc in a running server;	
8.	Slots for disks with direct access through the front panel of the chassis:	Minimum 12 x 3.5 "with possibility of replacing during operation (hot-swap).	
9.	Data storage controller (internally):	Minimum 1 PCIe 6Gbps SAS, minimum RAID 0,1,5,6,10,50,60, cache size minimum 512MB DDR2, with the possibility of working with SSD drives	
10.	Data storage controller (externally):	Minimum 1 Dual-Port PCI-E 8Gbps Fiber Channel Adapter	

11.	Type of the chassis:	For mounting in a standard 19 "Rack	
12.	Size of the chassis:	Maximum 4U	
13.	Power supply:	Minimum 2 redundant power modules with minimum power 800W, maximum 1400W, with the possibility of replacing power supply modules in a running server; The power supplies should operate at load balancing mode;	
14.	Cooling:	Redundant fans; Suction of cold air only through the front panel, releasing hot air only through the back panel;	
15.	Optical devices:	DVD-RW/+RW	
16.	Total Number of Expansion Slots:	Minimum: 5 x PCIe 2.0;	
17.	Module for remote diagnostics and administration:	Separate independent 10 / 100Base-T Ethernet System Management Port	
18.	Network adapters/ports:	Minimum 2 adapters (ports), type Ethernet 10/100/1000-Base-T Full Duplex; PXE 2.0 Support; TOE (TCP / IP Off Loading Engine)Support; Wake-On-LAN Support;	
19.	Support for operating systems:	Minimum: Microsoft Windows 2008/2012 Linux	
20.	Warranty:	At least 3 years on-site mode 24 x 7; Response time: up to 4 hours	
21.	Delivery time:	Within 45 days of signing the contract	
22.	Compliance:	CE, IT ECO Declaration, RoHS	

10 Delivery of the blade server system for virtualisation

The lot includes delivery, installation and commissioning of a Blade server system for virtualisation

10.1 Blade server system for virtualisation

	Parameter	Parameter requirement	Participant's proposal
1.	Chassis:	To be specified; By a manufacturer with an official service center in Bulgaria	
2.	Brand / Model / Product number:	To be clearly indicated in the offer	
3.	Type and size of the chassis:	For direct mounting in 19 "rack; Size not more than 10U	
4.	Slots for blade devices:	Min 16 pcs. (blade servers with two processors, storage blades for discs or storage blades for a tape device)	
5.	Power supply:	Maximum number of operationally replaceable (hot-swap) power modules should be provided, ensuring the redundant connectivity and performance of the system when the chassis is filled	
6.	Cooling:	Maximum number of operationally replaceable (hot-swap) cooling modules should be provided with ensured redundancy, automatic thermal control fans, suction of cold air through the front panel and releasing warm air through the back panel	
7.	Communication modules:	The chassis should support min 8 pcs. communication modules (switches and pass-through modules); To include 8Gb/s Fiber channel switches, providing redundant connection ports of each blade. Each switch should have at least 4 pcs. 8 Gb / s Fiber channel external ports, expandable to 8 pieces. 1 Gb / s Ethernet switches to be included, providing redundant connection ports on each blade server.	

		Each switch should have at least 8 pcs. 1 Gb / s Ethernet external ports	
8.	Network management:	Double redundant built-in module for remote monitoring and management of the chassis and blades with two built-in Ethernet LAN adapters and KVM Over IP support	
9.	Software for centralised management and monitoring of the chassis and the blades:	- Support minimum 4 pcs. chassis; - Support minimum 32 pcs. blade servers; - Possibility for automatic replacement of damaged blades with a reserve blade installed in the same chassis (internal fail-over); - Possibility for automatic replacement of eliminated (damaged) blades with new blades from the reserve installed in another chassis (external fail-over). - To include all necessary licenses to support the maximum number of blade servers in each chassis	
10.	Blade servers:	Minimum 16 pcs.	
11.	Manufacturer/brand:	From a manufacturer with an official service center in Bulgaria	
12.	Series and model:	To be specified	
13.	Compatibility:	With the proposed blade chassis	
14.	Processor:	Minimum 2 processors, eight-core with frequency> = 2,1 GHz, with minimum of 20 MB cache, Virtualisation Technology (Intel Xeon E5 2450 or equivalent) Minimum performance in accordance with Standard performance evaluation corporation – SPECint _rate2006 base score> 530	
15.	RAM:	- 192 GB DDR3, 1600 MHz memory installed with support for ECC protection; - Expandable to 384 GB; - Support for Memory Mirroring and Hot-Spare Memory	
16.	Ethernet LAN adapters (number of ports):	4 x Ethernet 10/100/1000-Base-T Full Duplex with support for Wake-On-LAN, TOE, a separate port for remote access and management	
17.	FC HBA (number of ports):	2 x 8GB/s FC ports	

18.	Slots for discs:	Min 2 pcs. 2.5 "SAS / SATA / SSD Hot plug with installed 2 pcs. 300 GB 10K SAS disks configured in RAID1 with the possibility of replacing during operation (hot-swap).	
19.	Video controller:	Built-in video controller with supported resolution at least 1024 × 768	
20.	Management and monitoring:	- Service chip for monitoring of the operating parameters; - System for pre-detecting hardware problems, related to CPU, memory and hard drive; - Remote management of hardware without a loaded operating system; - Remote management of BIOS without a loaded operating system; - Recording and archiving of errors and events affecting hardware, BIOS and the service chip; - Light indication on the front panel when registering a problem or system errors; - Remote update of the BIOS and Firmware via LAN; - Possibility for monitoring the current power consumption of the server	
21.	Supported Operating Systems:	MS Windows, Linux, VMware	
22.	Warranty on the chassis and the servers:	At least 3 years on-site mode 24x7; Response time: up to 4 hours	
23.	Delivery time:	Within 60 days of signing the contract	
24.	Deadline for installation:	Within 20 days of the Contracting Authority's request	
25.	Compliance:	CE, IT ECO Declaration, RoHS	
26.	Software licenses for virtualisation and monitoring – to have a single license fee to cover 100% of the proposed servers and to have the following functionality according to the technical requirements:	License for management server with the possibility of managing 8 or more (dual-processor) physical hosts according to the specifications described; Support for installing a hypervisor directly on the certified hardware without the need for host Operating System; Full virtualisation of memory, processors, logical discs and network adapters; Support for system hardware virtualisation technologies – Minimum	

| | | AMD-V, Intel® VT (Virtualisation Technology); Support for heterogeneous guest operating systems, including 64-bit (Guest OS) – min MS Windows Server 2008 – all supported guest operating systems to be specified; Number of logical processor cores on the host server, supported by the hypervisor – Minimum 128 pcs.; Volume of the physical memory on the host server, supported by the hypervisor – Minimum 1TB; At least 64 virtual processing cores per a virtual machine; Supported RAM per a virtual machine – min 1 TB; Number of simultaneously working virtual machines on one host server – min 320 pcs.; Possibility of clustering virtual machines; Possibility of dynamical distribution of the load, generated by multiple virtual machines on multiple physical machines; Possibility of moving virtual machines from one disk subsystem to another without disrupting operation of the virtual machine; Possibility of direct access from the virtual machines to the physical network and disk drives in order to increase the efficiency of the processor at loads that require constant access to the input and output devices; Ensure uninterrupted operation of the virtual machine in case of server virtualisation failure; Possibility of adding additional processors and memory to virtual machines without the need for their suspension; Free association of parts of the logical processor cores (logical core) from the host machine to the virtual machines; Free association of parts of the resources of the logical processor cores (logical core) from the host machine to the virtual machines; Setting minimum and maximum limits for CPU resources consumed by each virtual machine (QoS) Setting priorities for allocation of CPU resources for each virtual machine (QoS); Dynamic allocation of available physical memory between the operating virtual | |

machines depending on the current load;

Possibility of reallocating (oversubscription / overcomittment) of the physical memory available, so that the virtual machines will "see" and make use of bigger volume than is physically available;

Virtual cluster file system support;

Creating virtual disks stored in files in the host environment on DAS / NAS / SAN;

Direct presentation of logical units (LUN) from the host environment to the virtual machines;

Consolidation of Fiber Channel adapters and shared use by more than one virtual machine;

Boot from SAN support for the hypervisor;

Boot from SAN support for the virtualisation machines;

Possibility of integration with disc arrays of different manufacturers in order to transfer part of the disk operations on the disk controllers, such as copying / initialisation of files;

Support for multipathing policies to ensure access to disk systems and the possibility of integration of such policies by third-party manufacturers;

iSCSI support in virtual machines;

Transparent support for MPIO to work with redundant data storage network;

Possibility of integrating MPIO modules from other manufacturers to provide high reliability and load balancing for critical applications;

Support for NIC Teaming / NIC Trunking with load balancing of virtual machines for increased reliability and performance;

Possibility of creating virtual network switches;

Support for Layer 2 security for virtual network switches

Support for VLAN, VLAN tagging and group policies for ports of virtual network switches;

Possibility of shaping the network interfaces of each virtual machine;

Wake-On-LAN support for virtual network adapters;

IPv6 support by the virtualisation software and by the virtual machines;

Possibility of creating and managing virtual network switch that covers all virtualisation servers;

Support for private VLANs;

| | | Possibility of automated asynchronous replication of data on a separate virtual machine running;

Possibility of providing duplication of the state of a running virtual machine on a second physical server, so as to ensure operational continuity in case of failure of the first physical server;

Possibility of direct access to data in the virtual environment, at hypervisor level, in order to create backups and archives with a backup software;

Possibility of performing LAN-free backups and archives;

Possibility of performing backups of running VMs;

Support for SMI-S standard for management of virtual data storage systems;

Client application with a graphical interface (GUI), running under Microsoft Windows for management and monitoring of the virtual machines and the overall platform;

Client application with web interface (GUI) running in a standard web browser to manage and monitor the virtual machines and the overall platform;

System for automatic dynamic management of the allocation of physical resources between virtual machines, capable in real time to allocate the necessary resources for peak load virtual machines, according to pre-defined rules;

Possibility of manual or automatic migration of a running virtual machine from one physical server to another in real time;

Possibility of performing multiple automated migrations of virtual machines across multiple physical servers for optimisation and effective redistribution of the load between them;

Possibility of performing automated migrations between a group of disks to optimize the packing and loading of the respective discs;

Possibility of migrate physical server installation in a new virtual machine;

In cased of reduced resource consumption, a possibility of optimising the consumption of the virtual infrastructure by consolidating the operating virtual machines on fewer hosts and stopping the freed hosts; | |
|---|---|---|---|

| | | Support – at least 3 years in 24x7x365 mode; Possibility of obtaining detailed information and statistics about the resources in the virtual environment at the server level; Possibility of obtaining detailed information and statistics about the resources in the virtual environment of the virtual machine level; Possibility of generating automatic notifications if potential problems emerge; Collecting statistics on the resource consumption in virtual machines (CPU, RAM, Storage, Network); Backup of statistics for the resource consumption in virtual machines (CPU, RAM, Storage, Network); Visualisation of statistics for the resource consumption in virtual machines (CPU, RAM, Storage, Network) | |

11 Supply of communication equipment

The lot includes delivery, installation and commissioning of:

- A router.
- SAN switches.
- High-end network switches.
- High-end network switch from with optical modules.
- Low-end network switches.

11.1 Router

	Parameter	Parameter requirement	Participant's proposal
1.	Brand / Model / product number:	To be specified precisely in the offer	
2.	Chassis:	Possibility of rack-mounting	
3.	Interfaces:	To have 4 fixed 1GE SFP-based interfaces, equipped with copper transceiver modules	
4.	Installed RAM:	8 GB DRAM	
5.	Performance in packet forwarding:	3,5 Mpps (million packets per second)	
6.	Performance in the provision of different services:	7 Mpps (million packets per second)	
7.	Switching matrix:	Performance of the switching matrix: min 4 Gbps	
8.	Supported performance using encryption:	Min 1.5 Gbps using encryption algorithms 3DES and AES	
9.	Possibility of recognition of traffic flows through inspection of packages (NBAR), through software and / or hardware update:	To support	
10.	Generic Routing Encapsulation:	To support	
11.	VPN tunnels support:	Min 3000 IPSEC tunnels	
12.	IPSEC support in transport and tunnel mode:	To support	

13.	Support for package queues:	To support at least 100 000 package queues	
14.	Support for access control lists:	To support at least 3000 separate access control lists	
15.	Support for IPv4 routes:	To support at least 1 million IPv4 routes	
16.	Support for IPv6 routes:	To support at least 600,000 IPv6 route	
17.	Virtual Routing and Forwarding (VRF)support:	To support a minimum of 3,000 VRF copies	
18.	Routing protocol, with the possibility of balancing between routes with different metrics:	To support	
19.	Communication protocols supported:	IPv4; IPv6; OSPF; BGP; MPLS, L2/L3 VPNs, IP SLA, QoS, Netflow и NAT	
20.	Support for authentication protocols for centralised device management and restricting users without rights to change the configuration:	To support RADIUS и TACACS+	
21.	The device should provide a method for fast package switching of protocols, of protocol layer 3, through a separate database and table for the neighbouring devices:	Yes	
22.	Redundancy:	Redundant configuration of the power supply blocks	
23.	Warranty and Support:	Minimum 3 years in 24x7x365 mode, spare parts and manpower, including the provision of the latest versions of software; Minimum via telephone, over the Internet and at the client's site; Response time: within 4 hours of reporting a problem	
24.	Delivery time:		
25.	Deadline for installation:		

11.2   SAN switches – two pieces

	Parameter	Parameter requirement	Participant's proposal
1.	Brand / Model / Product Number:	To be clearly indicated in the offer	
2.	Type:	40-port 8 Gbps SAN switches	
3.	Number of ports:	Minimum 40	
4.	Active / licensed ports:	Minimum 40	
5.	Interface of the ports:	Minimum 8 Gbps Fiber Channel	
6.	Supported links:	8, 4, 2 Gbps (autosensing)	
7.	Short Wave SFP modules:	Minimum 40 pcs. SW 8 Gbps (hot-swap)	
8.	Management:	Minimum • Via graphical web interface • Via SNMP • Via Telnet	
9.	Connection with other FC switches:	License for pooling of optical switches	
10.	Management possibilities:	Real-time monitoring of the status, the performance and the security of the device; Automatic notification of the system administrator when problems arise;	
11.	Possibility of remote connection between two Dark Fiber switches:	License and support for connection at least 20 km through Dark Fiber fiber; Transfer rate of 8 Gbps	
12.	Activated additional options:	- Inter Switch Link (ISL) trunking - Performance Monitoring - Adaptive Networking - Server Application - Optimisation	
13.	Scalability possibilities:	Minimum: - Advanced Zoning - Integrated Routing	
14.	Accessories for installation:	All necessary accessories for mounting of the device in standard 19 "rack	
15.	Optical cords LC-LC:	Minimum 5 meters per each available SFP port	

16.	Power supply:	2 pcs. redundant	
17.	Power cables:	2 pcs.	
18.	Fans:	2 pcs. redundant	
19.	Physical dimensions:	Maximum 1U	
20.	Warranty and Support:	Minimum 3 years in 24x7x365 mode, spare parts and labor, including the provision of the latest versions of software; Minimum via telephone, over the Internet and on the client's premises; Response time: within 4 hours of reporting a problem	
21.	Delivery time:		
22.	Deadline for installation:		

11.3 High-end network switch– three pieces.

	Parameter	Parameter requirement	Participant's proposal
1	Brand / Model / Product Number:	To be specified precisely in the offer	
2	Type of the case / chassis:	For direct mounting in 19 " Rack	
3	Size of the case / chassis:	Maximum 2U	
4	Number of installed ports Type 1 (copper 10/100/1000 Mbps):	Minimum 48 units	
5	Number of installed ports Type 2 (1Gbit SFP):	Minimum 4	
6	Matrix switch:	Minimum 150 Gbps	
7	Productivity (switching):	Minimum 60 Mpps	
8	Number of the supported different MAC addresses:	Minimum 12000	
9	Support for technology to combine two or more switches (stacking):	Required	

10	Included in the equipment should be all the necessary modules, licenses and cables for use in stack:	Required	
11	Stack productivity:	Minimum 64 Gbps	
12	Support for IEEE protocols	Minimum: 802.1d; 802.1p; 802.1q; 802.1s; 802.1w; 802.1x; 802.3x; 802.3u; 802.3z; 802.3ad;	
13	IPv6 support:	Required	
14	Support for protocols and strategies for quality of service:	Minimum SRR, SPQ, WTD, CoS, DSCP, Traffic Shaping or equivalent	
15	Support for Jumbo Frames:	Yes	
16	Support for virtual interfaces:	Minimum 1000	
17	Support for routing protocols:	Minimum RIP, RIPng, OSPF, OSPFv3, BGPv4, PIM-SM, PIM-DM	
18	Support of protocol for redundant L3 interface	Minimum VRRP or equivalent	
19	VLAN support:	Minimum 1,000 VLANs and 4000 VLAN IDs	
20	Support for a protocol for detecting neighbouring network devices (hardware, firmware, port):	Required	
21	Support for Access Control Lists:	Minimum source/destination IP; source/destination TCP/UDP port; source/destination MAC;	
22	Management:	Minimum text environment – console, Telnet, SSH; SNMP v3; Web	
23	Possibility of forming redundant configuration (stack):	Required; In the configuration there should be all the necessary modules, interface cables and licenses to form a redundant configuration of at least two devices	

24	Software for managing and monitoring of switches (supports: general view of the topology, detection of network devices, monitoring – RAM, CPU, bandwidth, configuration):	Minimum 1 licence	
25	Warranty and Support:	Minimum 3 years, 24x7x365, spare parts and manpower, including provision of the latest versions of software; Minimum via telephone, over the Internet and on the client's premises; Response time: within 4 hours of reporting a problem	
26	Delivery time:		
27	Deadline for installation:		

11.4 High-end network switch optical modules

	Parameter	Parameter requirement	Participant's proposal
1	Brand / Model / Product Number:	To be indicated clearly in the offer	
2	Type of the case / chassis:	For direct mounting in 19 "Rack	
3	Size of the casing / chassis:	Maximum 2U	
4	Number of optical ports installed:	Min 12 pcs. type GE SFP, LC connector, SX transceiver, multimode	
5	Additional optical modules, supplied together with the switch:	Min 8 pcs. GE SFP, LC connector, SX transceiver, multimode	
6	Matrix switch:	Minimum 150 Gbps	
7	Productivity (switching):	Minimum 60 Mpps	
8	Number of supported different MAC addresses:	Minimum 12000	
9	Support for technology to combine two or more switches (stacking):	Required	

10	All the necessary modules, licenses and cables for use in stack should be included in the equipment:	Required	
11	Stack productivity:	Minimum 64 Gbps	
12	Support for IEEE protocols:	Minimum: 802.1d; 802.1p; 802.1q; 802.1s; 802.1w; 802.1x; 802.3x; 802.3u; 802.3z; 802.3ad;	
13	IPv6 support:	Required	
14	Support of protocols and strategies for quality of service:	Minimum SRR, SPQ, WTD, CoS, DSCP, Traffic Shaping or equivalent	
15	Jumbo Frames Support:	Yes	
16	Support for virtual interfaces:	Minimum 1000	
17	Support for routing protocols:	Minimum RIP, RIPng, OSPF, OSPFv3, BGPv4, PIM-SM, PIM-DM	
18	Support for protocol for redundant L3 interface:	Minimum VRRP or equivalent	
19	VLAN support:	Minimum 1,000 VLANs and 4000 VLAN IDs	
20	Support for protocol for detecting neighbouring network devices (hardware, firmware, port):	Required	
21	Support for Access Control Lists:	Minimum: source / destination IP; source / destination TCP / UDP port; source / destination MAC;	
22	Management:	Minimum text environment – console, Telnet, SSH; SNMP v3; Web	
23	Possibility of forming redundant configuration (stack):	Required; The configuration should include all the necessary modules, interface cables and licenses to form a redundant configuration of at least two devices	

	Parameter	Parameter requirement	Participant's proposal
24	Software for managing and monitoring switches (To support general view of the topology discovery of network devices, monitoring – RAM, CPU, bandwidth, configuration):	Minimum 1 licence	
25	Warranty and Support:	Minimum 3 years in 24x7x365 mode, spare parts and manpower, including the provision of the latest versions of software; Minimum via telephone, over the Internet and on the client's premises; Response time: within 4 hours of reporting a problem	
26	Delivery time:	4	
27	Deadline for installation:		

11.5 Low-end network switch

	Parameter	Parameter requirement	Participant's proposal
1	Brand / Model / Product Number:	To be specified precisely in the offer	
2	Type of the case / chassis:	For direct mounting in 19 "Rack	
3	Size of the case / chassis:	Maximum 1U	
4	Number of installed ports Type 1 (copper 10/100/1000 Mbps):	Minimum 24 units	
5	Number of installed ports Type 2 (1Gbit SFP):	Minimum 4 T/SFP	
6	Matrix switch:	Minimum 16 Gbps	
7	Number of supported different MAC addresses:	Minimum 8000	
8	Support for IEEE protocols:	Minimum: 802.1d; 802.1p; 802.1q; 802.1s; 802.1w; 802.1x; 802.3x; 802.3u;	

			802.3z; 802.3ad;	
9	Support for IPv6, IPv6 Neighbour Discovery, IPv6 Autoconfiguration, IPv6 Aggregatable Addrs:	Yes		
10	Support for protocols and strategies for quality of service	Minimum SRR, SPQ, WTD, CoS, DSCP, Traffic Shaping or equivalent		
11	VLAN support	Minimum 255 VLANs and 4000 VLAN IDs		
12	Support for protocol for studying the neighbouring network devices (hardware, firmware, port):	Yes		
13	Access Control Lists support:	Minimum: source/destination IP; source/destination TCP/UDP port; source/destination MAC;		
14	Management:	Minimum text environment – console, Telnet, SSH; SNMP v3; Web, LAN Base Image or equivalent		
15	Software for managing and monitoring switches (To support general view of the topology, detection of network devices, monitoring – RAM, CPU, bandwidth, configuration):	Minimum 1 licence		
16	Warranty and Support:	Minimum 3 years in 24x7x365 mode		
17	Delivery time:			
18	Deadline for installation:			

12 Delivery of VoIP equipment

This lot includes delivery, installation and commissioning of a VoIP Gateway.

12.1 VoIP Gateways

	Parameter	Parameter requirement	Participant's proposal
1	Manufacturer and brand of the IP gateway:	To be specified	
2	Series and model of the IP gateway:	To be specified	
3	Number of supported GSM channels:	Modules – 2 to 32 GSM channels	
4	Type of chassis and possibility of embedding:	Chassis for mounting in 19 "rack, size up to 3U, power supply, CPU, VoIP and AUX card	
5	Power supply:	220 V AC	
6	Module for GSM cards – 16 pcs.:	(2 GSM channels, up to 4 SIM cards per channel) with 2x MC55i, 850/900/1800/1900 MHz	
7	Functionalities:	Sending SMS via web or mail interface similar to MS Outlook; Possibility of call-back; Sending SMS in the absence of response; Possibility of remote monitoring via SNMP gateway client; Possibility of installation of modules – from 2 to 32 GSM channels; Auto CLIP forwarding – if the person who misses call returns the call the system should automatically redirect them to the person trying to contact them; Possibility of even distribution of outgoing calls between active channels / cards; Compatibility with popular IP PBX systems (Asterisk, Avaya, Siemens, Panasonic)	
8	Antenna splitter for 2 antennas:	32/2 (32 GSM channels – 2 antennas), loss of signal up to 15dB	

9	Antenna – 2 pcs.:	YAGI directional antenna, dual-band, 13db gain	
10	Antenna cable – 2 pcs.	1 cable – 20 m UMTS / GSM outdoor low-loss cable for YAGI antenna, signal loss 4dB; Cable 2 – 30m UMTS / GSM outdoor low-loss cable for YAGI antenna, signal loss 6,5dB	
11	Equipment:	All necessary power supplies and cables, a manual in Bulgarian language, software for SNMP monitoring and sending of SMS messages	
12	Warranty and Support:	Minimum 3 years, 24x7x365, spare parts and manpower, including provision of the latest versions of software; Minimum via telephone, over the Internet and on the client's premises; Response time: within 4 hours of reporting a problem	
13	Delivery time:		
14	Deadline for installation:		

Glossary

CDMI	Cloud Data Management Interface
GB	Gigabyte (i.e. 2^{30} or 10^9 bytes of memory storage)
Gbps	Gigabits per second (1,000 megabits per second)
LUN	Logical Units
NAS	Network-Attached Storage
SAN	Storage Area Networks
SAS	Serial Attached SCSI (Small Computer System Interface)
SATA	Serial AT Attachment, a computer bus interface
SDHC	Secure Digital High Capacity format, supports memory cards up to 32GB
SMI-S	Storage Management Initiative Specification
SNIA	Storage Networking Industry Association
TB	Terabyte (i.e. 10^{12} bytes)