



Cloud Services

Technical Annex:

Sites Description

Infrastructure Description

Services Levels

Premises

Solution called Cloud Services (hereinafter referred to as 'CS'), is built on infrastructure, standard of physical and logical security and support cutting-edge, high-bandwidth, on a campus distribution throughout the country. CS is the ASP Italia's platform of cloud and hosting services; it allows the Customer to initiate a strategy whose aim is the total outsourcing of server's infrastructure management. Below the description of sites "Rozzano" and "Cesano Maderno" as they are at the present. ASP Italia is an IBM business partner for computational infrastructures and Telecom Italia business partner for housing and connectivity services. ASP Italia provides CS from IDC distributed within the campus of Telecom Italia.

Telecom Italia's IDC are "factory" and, as such, are constantly developing and resizing.

Definition

Data Center means a physical structure, normally a partitioned building, designed and furnished to hold and manage a large number of IT equipment and infrastructure and to ensure physical and logical security of the information contained therein.

Site

Telecom Italia's Data Center used by ASP Italia are:

Cesano Maderno, Via Fulvio Bracco n° 39

Rozzano, Via Toscana n° 3/5

Cesano Maderno

Building consists of three floors plus a basement, for a total area of 7440 sqm.

Building dates back to the early 70s, and has been completely renovated and used as IDC in 2001.

There are 3562 sqm dedicated as server rooms, arranged on three floors (ground floor, first and second floor) and approximately 850 sqm of office space. The basement is exclusively used as technology space, as batteries, cylinders, UPS, etc. local.

DC Infrastructure characteristics

Electrical system for powering IT equipment

Plant is designed to ensure electrical continuity even in case of single faults along the distribution chain. Plant was achieved with more redundancy layers. The first is the main power source, typically a double transformer substation at 15 kV, one dedicated to ENEL and the other dedicated to EDISON. Power available from ENEL is 3.5 MW extendable to 5 MW, while EDISON's available power is 5 MW. These power supplies reach the building through diversified paths and pipes. Both are connected to the main medium voltage switchboard. Transformer substation is constituted of 5 transformers 2500 kVA including one spare. 4 generators, including one spare, each power 2250 kVA are installed. Generators control panel allows the monthly rotation of spare generator, to properly balance operating hours on all 4 generators. The two external underground tanks for generators contain a total of 36,000 liters of diesel fuel, which means a time, at full load, of 36 hours.

The power supply in continuity for the equipment is ensured by four chains of UPS, each composed of 2 UPS by 800 kVA in parallel (A + B configuration) and subdivided in two power stations located in completely separate halls, for a total of 3200 kVA overall available for IT workload. UPS batteries (2112 elements) are able to provide power, at full workload, to the data halls for 25 minutes. Available power is 800 W / sqm.

Thermal Dissipation

Cooling capacity available is 800 W/sqm. Production of cooling energy is provided by 4 cooling units installed, 2 of them with a cooling capacity of 990 kW, one of 980 kW and one of 1200 kW. One of the four cooling

units is spare. Cooling units control panel allows the monthly rotation of spare cooling unit to properly balance operating hours on all 4 cooling units.

Building Management System provides to the maintenance staff, in electronic form, all the useful information to intervene in case of problems. There are also 5 primary air handling units dedicated to the recycling of air in the data halls (3) and in the office area (2).

Air conditioning and cooling systems are designed to dissipate all the heat generated by the IT equipment, ensuring an environment temperature, measured in the cold aisles (aisles in which the air cooling is blown), up to 24+1° C and relative humidity between 30% and 70%.

LAN Physical structure

Data Network connection distribution starts from the TLC room (Star Center) where are collected the external communication flows of Telecom Italia: the communication backbone which constitute the level 2 are made up of optical fiber and installed on couples of switch panels (room switch layer 2). From these couples start the structured cabling to devices that are served by patch panel with 24 Lan points, making it possible to use many network cards for each device in order to implement redundancy of network point. Standard wiring is Category 6 copper cable Ethernet Gigaspeed, equipped with RJ45 connectors. In according with customer needs it is possible to use optic fiber cabling also.

Physical Security

Fire protection systems

The smoke detection and fire protection system is a set of three systems, smoke detection system Esser, system Vesda and the fire extinguisher system Eusebi. All areas, both offices and data rooms, are covered by smoke detection system. Typically data rooms are equipped with smoke detector points distributed under the floor, in the environment and in the false ceiling. Also in the data room there is Vesda system, made up by 1 to 4 spiral tubes, inside the false ceiling. The probes who are connected to these coils allow the system to aspire air environment and sample it by laser. Once "acquired" the sample, this system is able to detect all the air transparency variants ensuring a fire pre-alarm threshold that allows to prevent any kind of problem at the early beginning. In case of contemporary alarms by Vesda system and by, at least, two adjacent sensors of Esser system, Eusebi system automatically activates the emission of argon. The quantity of argon required to saturate environment, and thus extinguish the fire, has been certified as non-lethal, maintaining minimum level of oxygen presence in the air starting from 12%.

Flooding Systems

The anti-flooding system Raychem consists of a cotton coated braid with two probes rolled inside. Working on the refractive index of a signal sent out of the balanced cable, with a length of 385 m, if the braid becomes wet the system detects the alarm with a precision of +/- 1 m. This braid is placed along the entire path of refrigerant water pipes along all data rooms. Raychem system is connected to BMS system.

Physical Protection and Access Management

Outside security perimeter:

Perimeter fence that marks property border composed by a passive anti-climb protection with a minimum height of 2 m.

Outdoor areas are monitored by infrared barriers and / or video analysis systems and surveillance systems with video recording.

Pedestrian selective/single access.

Vehicular selective access.

Armed patrol.

Inside security perimeter:

Supervisory staff for constant and continuative indoor and outdoor areas vigilance, alarms supervision, visitors management with delivery badge in compliance with company rules and specifications for Telecom Italia's Data Center.

Reception Staff for constant and continuative access management.

Access to Supervisory and Reception Staff Area thru a triple-arm turnstiles.

Maximum internal security perimeter.

- Access gate to systems room with interlocked passive protection.
- Access control system with ENABLED list management.
- Doors Magnetic sensors to detect the door status.
- Emergency exits equipped with magnetic sensors .

All alarms are remotely visible by supervisory oversight.

Procedurals protections

- Personal Identification by identification ribbons badge holder
- Mandatory Access procedure

Building is equipped with a perimeter GPS system and an inside anti-intrusion system, managed and controlled by Reception 24 hours for 365 days/year. Every anti-intrusion alarm pilots a specific camera to project the event on the appropriate monitor.

Also the system is integrated with access control, if trying a forced entry, similar to intrusion, a specific camera cuts event: cameras are placed inside and outside the building.

For special areas have been installed badge readers with accesses control. Cameras are managed by digital systems.

Industrial Equipment Monitoring

Monitoring is done by a web server location (TAC VISTA by Schneider) installed in room TD B0. The system has 2 hard drives in raid configuration and double network card.

This system is used via web by authorized maintenance internal personnel and, as well as monitoring at real time equipment operations, it also manage manages the reporting of malfunctions and recording of microclimate parameters (temperature and relative humidity) within equipment rooms.

In response to an alarm signal, in addition to acoustic signal on the monitor, a message is sent on mobile phones of technological overseeing h24 service personnel.

In addition, the included software tracks all events on the system and provides statistics and trend data for any controlled variable.

Controlled systems by B.M.S. are:

- Electrical cabinet MT;
- Electrical cabinet MT/BT;
- Switchboards (bt generals, continuity A+B general, system rooms);
- UPS;
- MT/BT Transformers;
- Conditioners of system rooms;
- Cooling units;
- Generators;
- Electric pumps for refrigerant water;
- Multimeters;
- Sensors for Temperature and humidity;

Rozzano

Data Center of Rozzano is located within Telecom Italia district in Rozzano. Rozzano city is near Milano, in the south, nearby the western ring road, and it is approximately 30 minutes left from Linate airport. Data Center is made up of three buildings, one dedicated to offices and two dedicated to systems rooms and technological plants. Systems rooms are developed on an area of over 6500 square meters.

The systems rooms are subdivided into three distinct plants called:

- ROZZANO 1
- ROZZANO 2
- ROZZANO 3

ROZZANO 1 consists of nine systems rooms, completely modular, in order to allow rack-intensive hosting (up to 0.75 racks for square meter net), but also to quickly set up ad-hoc space in a personalized way. All electrical distribution systems, network and heat dissipation are made in the sub-floor in a modular way and have no visual impact on floor space.

ROZZANO 2 is built on a building dedicated to systems rooms and technological plants. Systems rooms are developed in a total space of 3675 sqm. Of these 3.500, subdivided in five rooms (3 rooms of 725 sqm and 2 rooms of 660 sqm approximately), are dedicated to production systems rooms. About 175 sqm are destined to TLC rooms and approximately 500 sqm are destined to logistics activities for the data center. The five systems rooms are designed in a completely modular way, in order to allow rack-intensive hosting (up to 0.75 racks for square meter net), but also to allow quickly set up of ad-hoc space in a personalized way. All electrical distribution systems, network and heat dissipation are made in the sub-floor in a modular way and have no visual impact on floor space.

Floor is placed on a metal grid and is made up by tiles having dimensions of 60 cm x 60 cm. The DC is based, logically and physically, on Telecom Italia's data band that is directly interconnected inside the building within a specific Telecommunications room (TLC).

ROZZANO 3 DC is built on an building dedicated to systems rooms and technological plants. Systems rooms are developed on a total space of 1,477 sqm. Of these 1,365, subdivided over two rooms (1 of 625 sqm and 1 of 740 sqm approximately), are dedicated to production systems rooms. About 112 sqm are destined to TLC rooms and more about 260 sqm for logistics activities for the data center.

Two systems rooms are designed in a completely modular way, in order to allow rack-intensive hosting (up to 0.75 racks for square meter net), but also to allow quickly set up of ad-hoc space in a personalized way. All electrical distribution systems, network and heat dissipation are made in the sub-floor in a modular way and have no visual impact on floor space.

Floor is placed on a metal grid and is made up by tiles having dimensions of 60 cm x 60 cm. The DC is based, logically and physically, on Telecom Italia's data band that is directly interconnected inside the building within a specific Telecommunications room (TLC).

DC infrastructure characteristics

Electrical system for powering IT equipment

The distribution of electricity is complete double radial full A + B derived from STS equipment behind UPS: all the electrical panels are in double section and the distribution to rooms is made by couples of armored bars with a pitch of 180 cm (intensive rack configuration).

Each environment has 5 transformers of 1250 kVA, in n+1 redundancy: in order to ensure the continuity of power in case of black-out, 4 series of sealed batteries allow the operation of the center at full workload for 12 minutes in absence of power supply, it is the necessary time to reach full operations of emergency power generators. Rozzano 2 has a rotor system as a total replacement of batteries. There are also three generators with available power of 1250 kVA.

All the electric system (up to each individual power outlet of the rack) is supervised H24 for 365 days a year and controlled by centralized Building Management Systems. It is also possible to install on racks power supply switches (STS, Source Transfer Switch) to provide power redundancy to mono-powered servers if needed.

Thermal Dissipation

All air conditioning and cooling systems are designed to dissipate all electricity potentially absorbed, ensuring a constant temperature between 19° and 23° Celsius. Cold generation is ensured by a water condensation plant consisting in 3 cooling towers of 1163 kW for each one which subtend 50 room conditioners of which 15 are able to autonomously produce refrigerant water.

This solution was introduced to assure full cooling redundancy even in case of fault on the hydraulic distribution coming from the Towers.

The refrigerant water distribution is guaranteed by a double ring circulation powered by 3 pumps, in redundancy n+1, of which one under UPS.

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Data Network connection distribution starts from the TLC room (Star Center) where are collected the external communication flows of Telecom Italia: the communication backbone which constitute the level 2 are made up of optical fiber and installed on couples of switch panels (room switch layer 2). From these couples start the structured cabling to devices that are served by patch panel with 24 Lan points, making it possible to use many network cards for each device in order to implement redundancy of network point. Standard wiring is Category 6 copper cable Ethernet Gigaspeed, equipped with RJ45 connectors. In according with customer needs it is possible to use optic fiber cabling also.

Physical Security

Smoke detection and fire-extinguishing / anti-flooding system

Safety features of equipped square meter of systems rooms are designed to minimize risks for people who working in IDC, and to avoid any tampering on systems. There is an ESSER smoke detection system with optical sensors placed under the floor, in the environment and in the false ceiling (sensors are placed in steps of 5 orthogonal meters).

This plant automatically manages the extinguishing system realized with FSQM00 gas: the peculiarity of this gas (which creates prevalence of nitrogen in atmosphere) is to be an inert gas, tolerable by man's body, and therefore, it allows to dispatch people evacuation quietly, not damage systems and it is effective in extinguishing the flame.

Sprinkler system is subdivided for each of 5 rooms in order to avoid unnecessary gas consumption. There are also extinguishing mobile machines and a fixed hydrants plant, in compliance with relevant laws and regulations.

For equipment rooms there is an air circulation system that automatically partitions itself in case of fire alarm. The IDC is also equipped with an anti-flooding system in the floor, which is activated by sensors located in a modular way along hydraulic distribution.

Physical Protection and Access Management

Outside security perimeter:

Perimeter fence that marks property border composed by a passive anti-climb protection with a minimum height of 3 m.

Outdoor areas are monitored by infrared barriers and / or video analysis systems and surveillance systems with video recording.

Pedestrian selective/single access.

Vehicular selective access.

Armed patrol.

Inside security perimeter:

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Access control system with ENABLED list management.

Doors Magnetic sensors to detect the door status.

Emergency exits equipped with magnetic sensors .

All alarms are remotely visible by supervisory oversight.

Procedurals protections

Personal Identification by identification ribbons badge holder

Mandatory Access procedure

The Telecom Italia area of Rozzano is completely enclosed with a boundary wall surmounted by steel bars, with two car entrances controlled by security guards for 24h 7/7. Within the area, the Data Center is further protected by a perimeter with boundary wall of 80 cm surmounted by a keller grid.

There is also a video surveillance system that allows a view of Data Center outer perimeter and the interior of systems rooms. The video surveillance system is managed by presidium of supervision operating 24 hours a day for 365 days. All cameras are recorded on digital system.

Monitoring Industrial Plants

Inside systems rooms there is a Johnson system to monitoring the industrial plants (mechanical and electrical) and to measuring temperature and humidity of room.

The monitoring is done by a specific central physically located at the supervisory oversight H24 and, in addition to showing the real-time conditions, it allows reporting of any anomalies about temperatures or UPS status, recording data on database to enable analysis.

They are monitored: Electrical Switchboards, STS, UPS, Transformers, Air Conditioners, Multimeters.

SLA IDC Infrastructure (project specifications)

Service level guaranteed for Data Center (DC) logistical components, for both double powered devices and in case of STS, is a yearly availability of 99,99%.

In case of devices without double power or without STS, the services yearly availability is guaranteed at 99,5%.

In the Center there is a Supervisory service for technological plants which provides support coverage 24 hours per day, 365 days per year in case of system failures.

Certifications

The Data Center in Cesano Maderno and Rozzano have obtained quality certifications related to infrastructure and processes:

- UNI CEI ISO/IEC 27001:2017 (ISO/IEC 27001:2013)

ASP Italia has obtained the quality certification related to service delivery processes and infrastructure management:

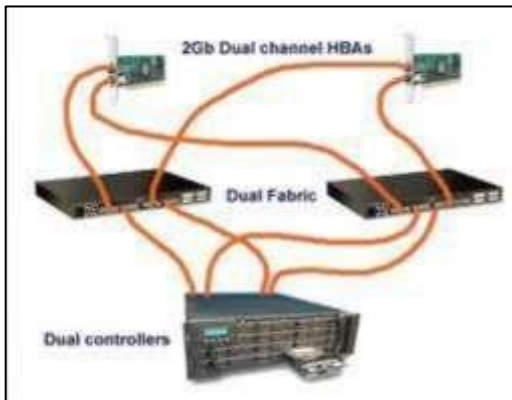
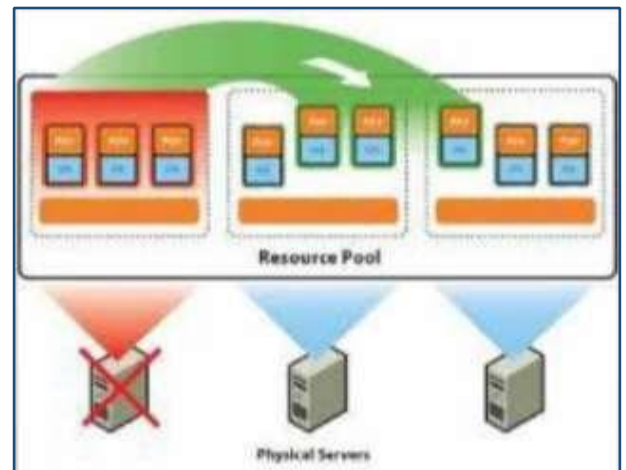
- ISO 27001:2022

Infrastructure, Processing Power

CS services are provided by a Cloud infrastructure based on Microsoft Windows Hyper-v technology.

Architecture is fully redundant, in terms of physical infrastructure and in terms of network, as well as based on Hypervisor with high reliability services (HA) through failover cluster implementations.

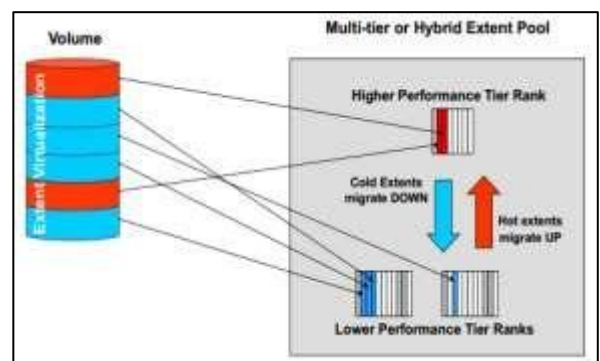
A failover cluster is made up of a group of independent computers that work together to improve availability and scalability. Servers included on cluster (called nodes) are interconnected. If one or more nodes in the cluster fails, service will be guaranteed by other nodes (a process known as failover). Cluster roles, also, are proactively monitored to make sure they work properly. In case of malfunctions, they are restarted or moved to another node.



Storage Infrastructure

It is implemented as SAN storage with fully redundant mechanical enabling performance and reliability characteristics for critical applications.

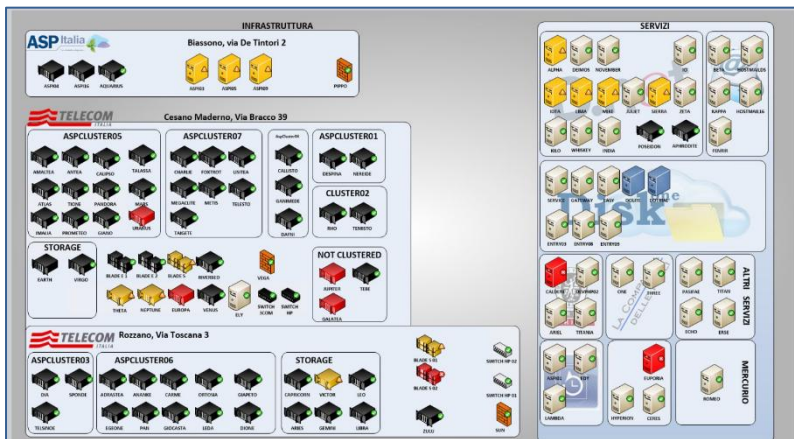
Best performances are assured by SAN Hybrid System (SSD, SAS, SATA) with dynamic disposition blocks through IBM System Storage® Easy Tier® to ensure a transparent and fully automated way the best possible performance in any workload condition.



Operational management and monitoring

ASP Italia manages its infrastructure through advanced monitoring and control systems.

The heart of the monitoring and management system is represented by Microsoft System Center formed by its components Operation Manager and Virtual Machine Manager.



ASP Italia also has a proprietary monitoring and alerting system that allows pro-active management of the infrastructure by alerting the H24 service personnel through visual signals, e-mails and SMS.

Backup Policy and Disaster Recovery

Backup

Backup are implemented through functionality provided by Microsoft System Center Data Protection Manager. Standard policies provide daily backup between hour 02:00am and hour 03:30am, every day. Virtual machines images are stored in two copies: the first one on devices within the same DC, the second one, which takes place between hours 04:00am and hour 09:00am, on devices located in "secondary" DC.

Number of backup versions, kept in the two sites, is agreed with the client with a minimum of 5 to a maximum of 448 days.

Disaster Recovery

Contractual options allows two different scenarios;

- Virtual Machines Replication

In this scenario, we define two "sites": the "primary site", which is the location where usually work the virtualized environment, and the "replication site", which is the location of the server location that will receive replicated data. In the primary site, the primary server is the physical server that hosts one or more primaries virtual machines. In replication site, the replication server hosts replicated virtual machines. When replication is in progress, the changes in the primaries virtual machines are periodically transferred thru the network to the replicated virtual machines. The exact frequency of the replication varies depending on the time required to complete a replication cycle. Typically, replication approximately occurs every 5-15 minutes. In case of unexpected failure in the primary server, for example as a result of a serious hardware problem or a natural disaster, it is possible to enable replicated virtual machines so that they assume the workload instead of the primary virtual machines. In this case we speak of "unplanned failover."

Data availability is guaranteed at the time of the last replication process (RPO, 5 to 15 minutes). In this way the recovery time (RTO) is reduced to the time needed by the client to divert their network routes to reach the "Secondary" site.

- Restore from Remote Backup

In this scenario, virtual machines are restored from the last backup stored in the "Secondary" site. With normal daily backup the maximum RPO is 29h (backup frequency + time required for replication backup on secondary site). The last version data is that one of the last backup tasks. Recovery time (RTO) is guaranteed as NBD (Next Business Day).