

MiVoice MX-ONE, Availability Calculation

DESCRIPTION



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GENERAL

The system is built with distributed software architecture; each service node server handles a maximum of 15000 users. The actual number of users per server depends on the type of terminal e.g. SIP, DECT, analog extension.

Each module performs all call processing and all telephony type services for registered users, including selection of required gateways for call establishment.

A user may register (with automatic load-sharing over active servers) with, and be served with call processing by any module in the system.

Each server can handle a maximum of 15 media gateways.

Servers can be provided in an N+1 configuration or use VMware High Availability or Fault Tolerance. VMware Fault Tolerance provides zero downtime for servers and is not further mentioned in this document.

Media gateways represent the only single point of failure in the system but as all media gateways are available to all users (with the exception of TDM terminals which are connected via specific boards), the effect of a loss of a media gateway is a reduced Grade of Service.

1.1

NETWORK REDUNDANCY

The IP network providing connectivity between system servers is critical for the operation of the system. A duplicated internal LAN, i.e. where all servers are connected to two different LAN switches, is assumed for any high availability application with MX-ONE.

Redundant LANs is available using link aggregation or bonding (IEEE802.3AD) where the IP infrastructure is setup to provide two physical links to the network for the same IP address (one active and one passive).

With bonding, if the active physical link fails, the passive link goes active automatically, and the IP network reconfigure itself to handle this situation.

1.2

SERVER REDUNDANCY

Server redundancy can be achieved by two different methods, MX-ONE n+1 or VMware HA. Using either method will virtually eliminate the impact on availability from server failures as can be seen from the calculations in chapter 2.

The VmWare HA have a quicker change over time than n+1 but the important benefit is the fact that adds, moves and changes are allowed when a back-up server is active.

N+1 redundancy is an active/standby configuration, the extra server is standby with programs loaded but no data. In a fault situation, the standby server loads the failed servers data automatically and takes control over its associated media gateways. Any server can access and load static data for any server in the same redundancy cluster.

1.3

FAILOVER

Failover is automatically performed between different servers in the same system. The system is built with a distributed architecture, irrespective of size (100 - 500000 users), each logical server (software module) handles a maximum of 15000 users.

Failover for IP based end users is controlled by the end-user equipment. IP telephones (including softphones) regularly check that the SIP registrar/proxy or gatekeeper (for H.323 software modules in MX-ONE) it is registered with is alive. If not, the telephone will automatically re register with another gatekeeper or SIP registrar/proxy.

If a user is trying to make a call and the telephone does not get response on the request to set up the call, the telephone will automatically re register with an available gatekeeper or SIP proxy/registrar.

1.4

SUPPORT OF THE COMPLETE CAPACITY IN THE EVENT OF A FAILURE

As we do not have any central control, our redundancy features allows the customer to configure according to needs. With a N+1 configuration, if the n active servers are configured for maximum number of users, the extra, redundant server is sufficient for a one server failed situation. For extra resilience, the system can be provided with extra active servers and media gateways.

Alternatively, if there are only IP or SIP terminals in the network, HLR redundancy may be used. In this scenario, each server can handle up to 15000 back-up or guest IP/SIP registrations on top of their normal users, but the total shall never exceed 15000 users per server. Therefore, enough free capacity should be left in each server to be able to handle the overflow should a server fail. As an example, if a network has 20000 IP/SIP users, ideally this should be spread over 3 servers with a maximum of 7000 users per server. In the event that one server fails, the other 2 servers would have sufficient capacity to take over all the users from the failed server, thus ensuring full capacity in a back-up situation.

It should be noted that N+1 and HLR types of redundancy can be used simultaneously.

From a IP/SIP user unavailability perspective, the average unavailability for an individual user with HLR redundancy is 5 minutes with the default setting of 10 minutes for the keep alive timer in the terminals.

With N+1 redundancy the time is basically fixed to around 5 minutes for all impacted users, i.e. which redundancy method that is used does not have any impact on the availability data.

2 AVAILABILITY CALCULATIONS

2.1 ASSUMPTIONS

The system is provided with network redundancy.

The system is configured with N+1 server redundancy.

The IP infrastructure is not included in the calculations, high availability can be provided with a suitable configuration.

Disaster scenarios are not included in the calculations, i.e. only normal equipment failure rate is used.

The system is deemed unavailable if 50% or more of a normal traffic case/users are denied service.

A user is deemed unavailable if he cannot make/receive calls, loss of a specific feature (e.g. Voice Mail) is not included.

2.2 SYSTEM AVAILABILITY

With the distributed architecture, multiple faults (3 or more) must occur as long as the system comprises more than 3 servers. The probability of such a scenario is virtually zero.

The offered system will never be unavailable due to normal hardware faults.

2.3 UNAVAILABILITY FOR IP EXTENSIONS

For IP extensions, the following situations will make a specific user unavailable.

Note: Contributions from the IP infrastructure are not included.

Failure of the phone, MTBF varies between 10 and 125 years for the different models.
MTTR 2 hours assuming spares held locally.

Unavailability (worst case, MTBF 10 years), $1/10 * 2 \text{ hours} / 8760 = 0.0000225$

Unavailability (best case, MTBF 125 years), $1/125 * 2 \text{ hours} / 8760 = 0.00000183$

Change over to standby server, MTBF is 10 years for MX-ONE ServiceNode and change over is approximately 5 minutes. Using HLR redundancy gives the same result for the average extension.

Unavailability, worst case, with 0.2 Erlang/extension, $1/10 * 0.2 * 5 \text{ minutes} / 525600 = \text{negligible}$.

Double server failure which may affect a specific user, with an MTBF of 10 years, 4 hours MTTR and 10 active servers in the redundancy cluster.

MTB double failure. $MTBF * MTBF / MTTR / 8760 \text{ hours} / 10$ (=number of servers) = 21900 years.

Unavailability, $1/21900 * 4/8760 = \text{negligible}$.

Availability for IP extensions varies between 99.9978% and 99.9999%

2.4 UNAVAILABILITY FOR ANALOG EXTENSIONS

The unavailability for analog extensions is higher as specific hardware needs to be operational.

As seen from the previous paragraph, unavailability due to server failures can be neglected.

Telephone, no data is available.

2.4.1 UNAVAILABILITY FOR ANALOG EXTENSIONS IN MX-ONE LITE (3U)

Analog extension interface board, ELU34, MTBF 15 years.

MGU2, MTBF 60 years.

LBP24 (excludes power adapter), MTBF 54 years.

MTBF for above, 9.8 years.

MTTR, is set to 4 hours.

Unavailability for analog extension, $1/9.8 \cdot 4 / 8760 = 0$

Availability for analog extension is 99.995%

2.4.2 UNAVAILABILITY FOR ANALOG EXTENSIONS IN MX-ONE CLASSIC (7U)

Analog extension interface board, ELU34, MTBF 15 years.

MGU2, MTBF 60 years.

Power, DC/DC, MTBF 450 years.

MTBF for above, 11.7 years.

MTTR, is set to 4 hours.

Unavailability for analog extension, $1/11.7 \cdot 4 / 8760 = 0.000046$

Availability for analog extension is 99.995%

2.5 UNAVAILABILITY FOR DIGITAL EXTENSIONS

The unavailability for digital extensions is higher as specific hardware needs to be operational.

As seen from the previous paragraph, unavailability due to server failures can be neglected.

Telephone, MTBF between 122 and 333 years (122 years used below).

2.5.1 UNAVAILABILITY FOR DIGITAL EXTENSIONS IN MX-ONE LITE (3U)

Digital telephone, highest MTBF 122 years. (used in calculations), lowest MTBF 333 years.

Digital extension interface board, ELU33, MTBF 36 years.

MGU2, MTBF 60 years.

LBP24 (excludes power adapter), MTBF 54 years.

MTBF for above, 14.5 years.

MTTR, is set to 4 hours.

Unavailability for digital extension, $1/14.5 * 4 / 8760 = 0$.

Availability for a digital extension is 99.997%

2.5.2

UNAVAILABILITY FOR DIGITAL EXTENSIONS IN MX-ONE CLASSIC (7U)

Digital telephone, MTBF 122 years.

Digital extension interface board, ELU33, MTBF 36 years.

MGU2, MTBF 60 years.

Power, DC/DC, MTBF 450 years.

MTBF for above, 18.23 years.

MTTR is set to 4 hours.

Unavailability for digital extension, $1/18.232 * 4 / 8760 = 0.0000325$

Availability for digital extension is 99.997%

2.6

UNAVAILABILITY FOR MEDIA GATEWAYS

Unavailability for a media gateway will have an effect for small systems so a calculation is done for systems with few media gateways.

For systems with three or more media gateways, unavailability (a catastrophic failure) needs at least (for a three MG system) a double failure for the system to be classified as unavailable.

Two different media gateways are available, MGU2 based and the Media Server ("soft-MGU"). The Media Server has no specific hardware, its availability only depends on the host server, so it is excluded here.

2.6.1

UNAVAILABILITY FOR MGU2 BASED MEDIA GATEWAYS

MGU2, MTBF 60 years.

Power, DC/DC, MTBF 450 years (MX-ONE Classic)

LPB24 (excluding power adaptor), MTBF 54 years (MX-ONE Lite).

MTBF for above, 52.94 and 28.42 years respectively.

MTTR, is set to 4 hours.

Unavailability for the MX-ONE Classic, $1/52.94 * 4 / 8760 = 0.000008$

Unavailability for the MX-ONE Lite, $1/28.42 * 4 / 8760 = 0.0000126$

Availability for the media gateways is between 99.9992% and 99.9984%