Mitel 3300 ICP

High Availability Solutions for the Hospitality Market

Product Information Note

MITEL

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The purpose of this information note is to detail the Mitel® 3300 IP Communications Platform (ICP) high availability options available to Mitel customers in the hospitality industry.

Product Note Overview

This product note is designed to investigate the high availability information of Mitel's 3300 ICP hospitality solution.

This information note will focus on a specific type of large analog and IP solution. More general information about Mitel's IP architecture can be seen in the IP Architecture Information Note available on Mitel OnLine (MOL).

3300 ICP Hospitality Solution

Historically, large hotels garnered large direct revenue streams from guests using the hotel telephones. In addition to direct telephony revenues, the telephone system supported other hotel revenues indirectly by allowing guests to order room service or book other hotel services. As a consequence, the hotel telephone system of the 1980s, 1990s and early 2000s became essential to hotel revenues, and as such, specific hospitality features and functions were developed for the industry.

With such large revenues integrated into the telephone system, the drive from the hotel industry was to ensure continuous service with each minute the system being unavailable counted in dollars. In the 1980s and 1990s, the route to delivering continuous service was to use redundant components.

As telephony solutions have migrated to an IP infrastructure it is important, for the reasons noted above, that we examine and show how the infrastructure change has effected solution availability for the hospitality market. As such, it is vital to understand that although the architecture of the solution has changed, the fundamental requirement from the industry has not—high availability solutions or continuous service are the starting point, not the end point.

Rather than focus on each and every feature of the 3300 ICP that is used in a hospitality solution, this document will focus on the underlying high availability position.

As the following technical section will make clear, there are many different factors that make up system availability, however, for the benefit of this document we are assuming that the hospitality customer is looking for a high availability solution that involves both IP display and analog telephones.

To help focus on a generic hospitality solution, we will investigate the following characteristics:

- Over 2000 analog guestroom telephones
- Four x digital T1/E1 links to the public network
- 200 IP display phones
- Connection to a front of house system via a Property Management System (PMS) interface
- A number of consoles for the hotel switchboard operators
- Connection to a call management system

The solution, as described above, has been modelled below to show the power of a distributed architecture. Where previously a traditional solution would have been reliant on a single processor, hard drive and power supply (with redundant back-ups) and non-redundant line card cabinets, the 3300 ICP solution now utilizes 15 processors, redundant power supplies, and multiple survivable routes.

NO SINGLE POINT OF FAILURE RENDERS THE ENTIRE SOLUTION UNAVAILABLE

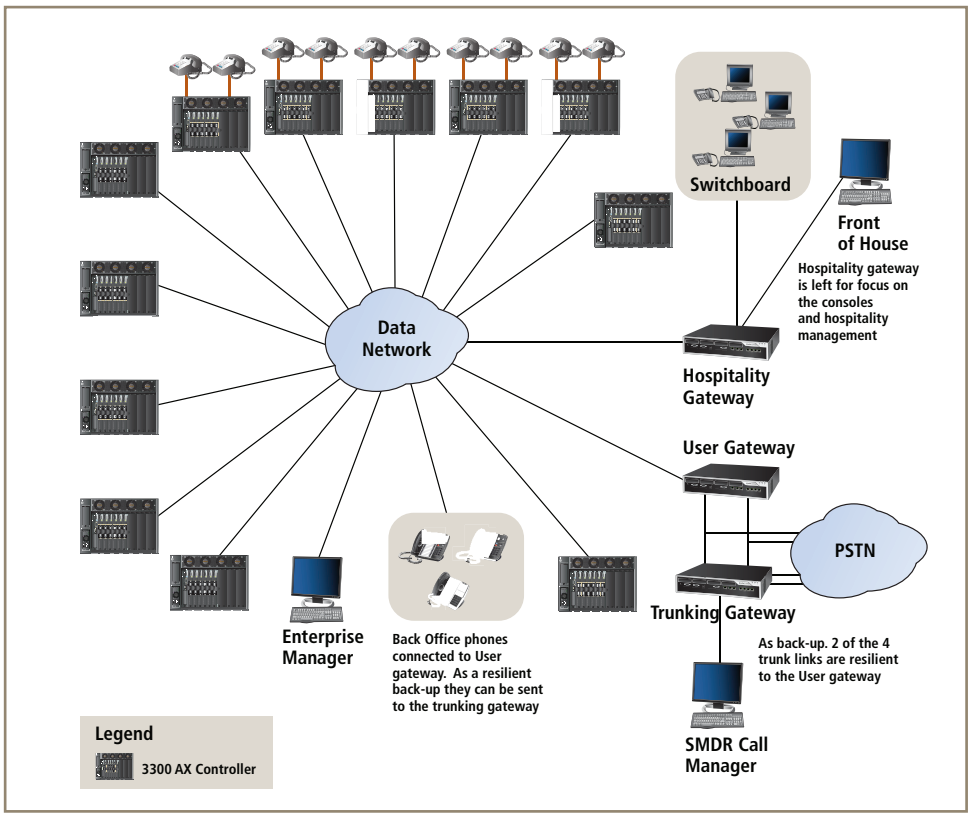

Figure 1: Distributed Architecture in a Hospitality Environment

The Underlying Technical Fundamentals

Although this document is designed to give a top level understanding of high availability solutions for the hospitality market, there is some detailed technical information that needs to be explained so that the power of the distributed solution can be made clear. The following few pages explain the detail behind telephone solution availability.

In the past, the reliability rating of traditional PBX hardware was the most significant factor effecting telephone system availability. With IP-based telephony systems, there are many more factors in addition to PBX hardware reliability that will have an effect on telephone system availability.

Successful deployment and operation of voice over Internet protocol (VoIP) telephone systems requires the use of an appropriate network service model that is a blend of the traditional telephone network service model and the high availability data network service model.

The Mitel Seven-Layer Business Continuity Model

When discussing telephone system availability, some vendors make the mistake of only discussing the reliability of their own hardware components. This ignores the fact that a chain is only as strong as its weakest link. To truly understand system availability requirements, Mitel uses a seven-layer business continuity model which is shown in Figure 2.

The seven-layer business continuity model shows that the telephone system availability is dependent on many different factors and that overall system availability should not be based solely on the reliability of the PBX hardware.

The seven-layer business continuity model provides an overall view that addresses all components that influence system availability. These components are:

- **PBX Hardware** – this hardware forms the foundation of the business continuity model, e.g., PBX hardware, server hardware.
- **PBX Software** – this software runs on the PBX hardware and can have a major impact on system availability, e.g., operating system, call control software, application software.
- **Data Network** – this includes data networking hardware and the data networking protocols. Overall system availability is dependant on the data network availability, e.g., Layer 2 switches, routers, and networking protocols.
- **Power Distribution** – this fundamental requirement needs to be taken into consideration so that if required, equipment can continue to be powered even under fault conditions, e.g., uninterruptible power systems, generators.
- **Geography** – system availability can be enhanced when the network design takes geographical distribution of equipment and personnel into account when the solution is dispersed across multiple locations and / or cities.
- **Process** – company processes related to maintenance and repair need to be considered since these processes can have a direct effect on availability.
- **People** – the availability of maintenance and repair personnel and their impact on system availability needs to be considered, for instance, who are the individuals responsible for repair and maintenance and are these people located on-site or off-site.

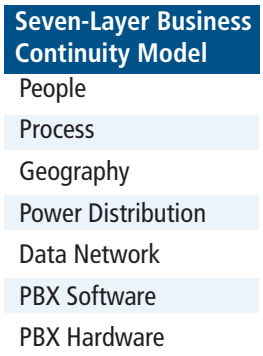

Figure 2: The Seven-Layer Business Continuity Model

It is quite straightforward to quantify availability figures for the first four lower layers of the Seven-Layer Business Continuity Model, but less easy for the higher levels, since these levels are less dependent on actual equipment and software.

The business continuity requirements for smaller hotels would typically be met by addressing the first four lower layers of the Seven-Layer Business Continuity Model. Availability analysis for smaller hotels tends to stop at the Power Distribution level.

For much larger hotels with critical operations, however, the upper layers of the Seven-Layer Business Continuity Model need to be considered.

It is therefore very much dependent on the level of business continuity required as to what value of availability is needed and at what level of the model this availability is needed.

Furthermore, a hotel may have different business continuity requirements within the same premise. For example, the solution may need to provide a very high level of availability for the guests, a medium level of availability for public areas, and a lower level of availability for staff areas.

Telephone system reliability, redundancy and resiliency are all inter-related and directly effect system availability. A highly reliable non-redundant system will provide users with a high level of availability. Redundant and resilient design techniques can provide users with a higher reliability system than non-redundant systems by providing continued availability even when a system failure occurs.

What are MTBF, MTTF, MTTR, and Availability?

There are a number of metrics that are used by manufacturers to convey the reliability and repair ability of individual components. These metrics can also be extended to convey the reliability and repair ability of a complex grouping of components such as a system or a network.

These metrics are:

- **MTTF:** MTTF stands for **Mean Time to Failure**. This is the statistical length of time that a component will operate (uptime) before a failure occurs.
- **MTTR:** MTTR stands for **Mean Time to Repair**. This is the length of time that will elapse from the time a component failure was detected to the component being restored to service (repair time).
- **MTBF:** MTBF stands for **Mean Time between Failures**. This is the statistical length of time elapsed between sequential component failures. This metric also includes the time it takes for the component to be restored to service, in other words, MTBF is equal to the MTTF plus the MTTR (or uptime plus repair time).

Figure 3 illustrates the relationships between MTTF, MTTR, and MTBF.

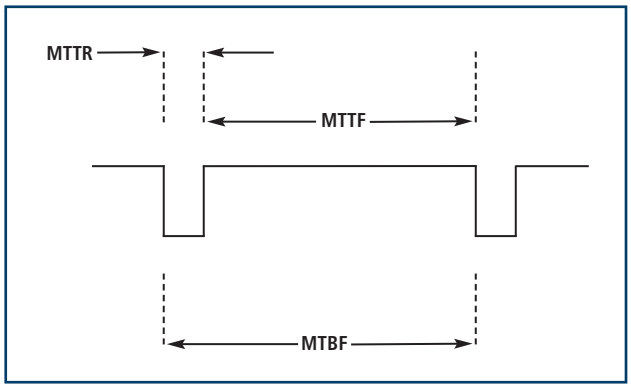

Figure 3: MTTF, MTTR, and MTBF

While metrics such as MTTF, MTTR, and MTBF are necessary for analyzing component and system reliability, some vendors mislead their customers by focusing exclusively on the MTBF ratings for their product.

Mitel understands that what really matters to the **end users** of the product is **system availability**.

System availability expressed as a percentage of time is defined by:

- Percentage Available = MTTF / MTBF = uptime / (uptime + repair time)

System unavailability expressed as a percentage is defined by:

- Percentage Unavailable = MTTR / MTBF = repair time / (uptime + repair time)

It is a common practice within the industry to refer to the reliability level of a product, or system, as 5 '9's or 5 x 9, however what is actually being referred to is the availability expressed as a percentage for a particular product or system. When a product has an availability of 5 '9's it is in fact available 99.999 percent of the time.

For Example
A "product" has a MTTF or uptime of 2.5 years and a MTTR or repair time of 10 hours. What is the availability of this "product"?

- If uptime = 2.5 years and repair time = 10 hours
- There are 8,760 hours in one year so repair time can be expressed as 10 / 8760 years
- (Percentage Available) = 2.5 / (2.5 +(10 / 8760)) = 0.9995 x 100%
- (Percentage Unavailable) = 1 - Percentage Available = 0.0005 x 100%

  This system is available 99.95 percent of the time, or in other words, the system is providing 3 '9's availability. Alternately, this system is unavailable 0.05 percent of the time.

System Availability?

As mentioned above, different solutions will have different system availability requirements. To determine the system availability requirements for a particular solution, the following requirements need to be established:

- Which services have an availability requirement?

A solution will have certain availability requirements for basic telephone operation and the same solution may have different availability requirements for the voice mail system or advanced telephony features.

Availability requirements for all services need to be defined so that the each of the layers in the business continuity model can be designed to meet these requirements.

- What level of service outage is acceptable?

The business continuity requirements need to be understood so that an acceptable level of service outage can be defined. For example, a solution that needs phones operational from nine to five, five days a week will accept a different level of system outage than a solution that needs phones operational twenty four hours a day, seven days a week.

Quite often hardware products such as a PBX can achieve better than 5 '9's of availability, but it must be remembered that the overall system availability is defined by the weakest link. The weakest link in a system could be located at any layer of the business continuity model; this is why it is important to look beyond the MTBF rating of a single hardware component.

Older standards that specify the requirements for PBX or Public Network availability in general only considered the hardware components and only addressed the core of the network.

For example, telephone companies will typically provide their residential customers with guarantees that when a fault occurs, service will be restored by midnight of the next working day (weekends don't count). This translates to a 99 percent level of availability. Telephone companies usually offer their business customers with multiple lines a 99.9 percent level of availability.

Analyzing 3300 ICP availability data, it is clear that the repair time is one of the crucial parts of the availability calculation. In the below table, we assume that the repair time is set at four hours and show the system availability times for some of the major 3300 ICP components.

Based on four hours repair time

Device	Availability
Mitel 3300 MXe Controller, without redundancy	99.996%
MXe Controller, with redundancy	99.997%
Mitel 3300 AX Controller with single PSU	99.997%
AX Controller with Redundant PSU's	99.998%
Mitel Single Line IP Phone	99.999%
Mitel Multiline IP Phones	99.998%
Resilient MXe Controllers	**99.999999%**

Table 1: Mitel Product Availability, Four Hour MTTR

Please note that these availability figures were correct at the time of writing but the reader should look at the Mitel system engineering documentation for up to date availability figures.

For customers who have the ability to repair systems themselves or who negotiate an enhanced maintenance contract, the below table shows what happens to the availability figures if the repair time is reduced to one hour.

Based on one hour repair time

Device	Availability
MXe Controller, without redundancy	99.999%
MXe Controller, with redundancy	99.999%
AX Controller with single PSU	99.999%
AX Controller with Redundant PSU	99.999%
Mitel Single Line IP Phone	99.999%
Mitel Multiline IP Phones	99.999%
Resilient MXe Controllers	**99.999999%**

Table 2: Mitel Product Availability, One Hour MTTR

Please note that these availability figures were correct at the time of writing but the reader should look at the Mitel system engineering documentation for up to date availability figures.

There are a couple of clear takeaways from this technical section, and in particular the availability tables:

- Solution availability needs to incorporate ALL systems and processes involved in the delivery of the relevant service—for instance, what is the availability of the data network, the front of house system and the public network connections?
- 99.998 percent availability in effect means a theoretical potential of 10.5 minutes unexpected downtime per year.
- By incorporating processes and systems such that the availability is raised to 99.999 percent, then the potential for unexpected downtime per year becomes 5.2 minutes.
  - The customer needs to ensure their availability requirements are understood and matched reliably through the business.
- Resilient distributed IP deployments deliver systems with far higher availability than any traditional PBX could ever hope to match.

Further detail on high availability can be found in the Telephone System Availability document from Mitel System Engineering.

3300 ICP Hospitality Solution

Having looked at some of the in-depth technical detail we can now look again at the 3300 ICP hospitality solution and analyze the availability of the solution.

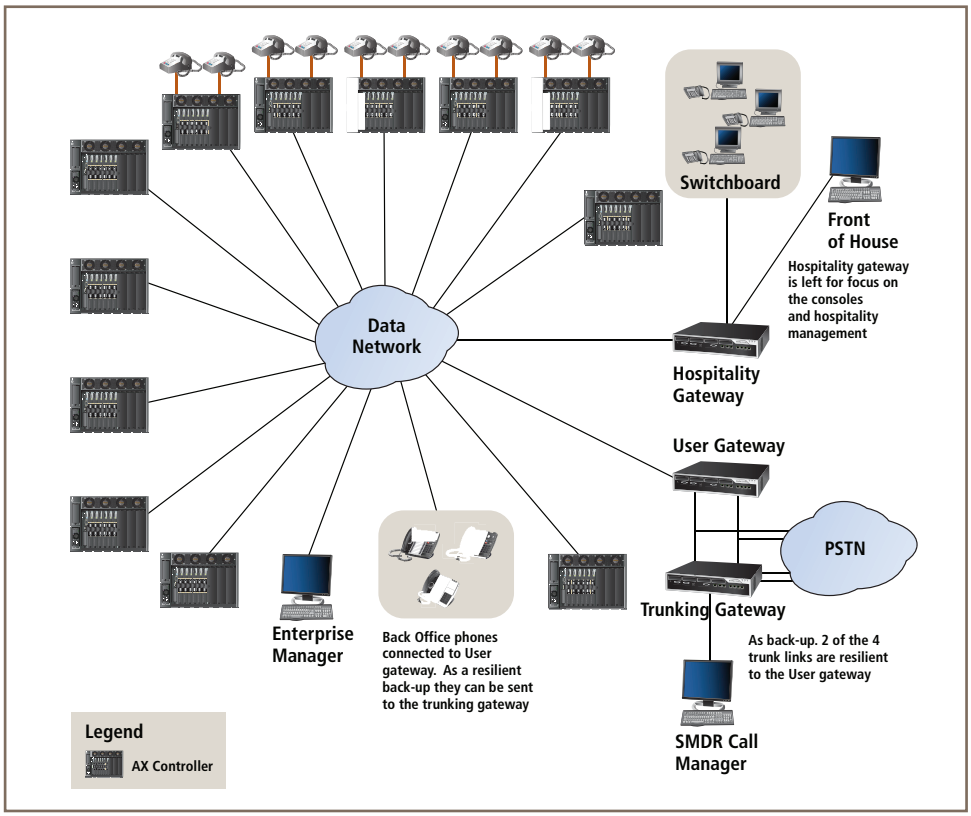

Figure 4

The first thing to note is that unlike a traditional redundant solution, there is no single point of failure for the solution as a whole. If any part fails, then the remainder continues to work around the failure*.

- If a guest AX Controller is unavailable, it will only effect 1/12 of the entire hotel's guests—less than the 10 percent mark that would typically be classified as a critical failure.
- Standard hardware availability figures mean the AX Controller can be limited to theoretical downtime of 10 minutes per year. The availability figures for an AX Controller can be increased to 99.999 percent by improving other processes within the continuity model.

*** This assumes the Data Network is designed ensuring continuity requirements are correctly catered for.**

- If the 3300 ICP trunking gateway fails, then the digital links can fail-over to the user gateway ensuring service continuation.
- Resilient 3300 ICP user gateways deliver 99.99999 percent availability.
  - From a system software perspective, the theoretical downtime for 3300 ICP IP phones on a user gateway would be 75 seconds or 99.9997 percent availability. [1]
- The 3300 ICP hospitality gateway can be made redundant with RAID hard drives and power supplies, giving 99.997 percent availability. This can be raised to 99.999 percent by improving other processes within the business continuity model.
  - The theoretical difference in unexpected downtime between 99.997 percent and 99.999 percent availability is approximately 10 minutes per year.
- The operator console availability will be dependent on the type of PC used.
- The Front of House System availability would need to be confirmed with the relevant supplier but would be AS IMPORTANT as the reliability of the 3300 ICP hospitality gateway.

Customer Pricing

Following the debate on system availability, the next phase in the discussion with an end customer normally involves pricing. The question from the end customer is normally formed as follows:

With all those systems and platforms it must be more expensive than a Mitel SX-2000 LIGHT?

Rather than get involved in analyzing each solution part by part, the easiest way to show the comparison between a SX-2000 LIGHT and a group of Mitel 3300 Controllers is to show the pricing comparisons on two line graphs,

1. End-user purchase price for the solution
2. End-user price per line

[1] **The 75 seconds is made up of 45 seconds for the phones to recognize a system failure and 30 seconds for the 300 phones to resume service from the secondary controller.**

The following graphs have the core system hardware and software included for provisioning analog phones only. To ensure that it is a fair comparison, the 3300 ICP solution includes AX Controllers for the analog phones and for solutions above 1,000 ports, multiple MXe Controllers are included for user and trunking gateways.

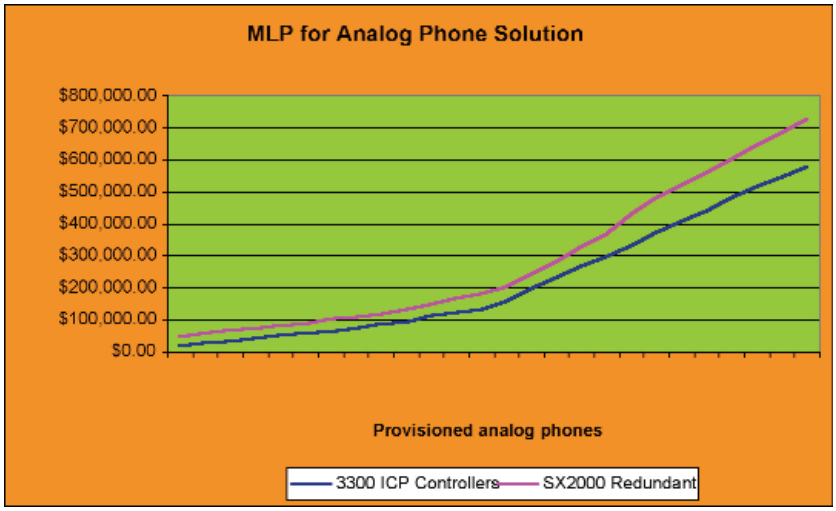

Figure 5: End-User Purchase Price for the Solution

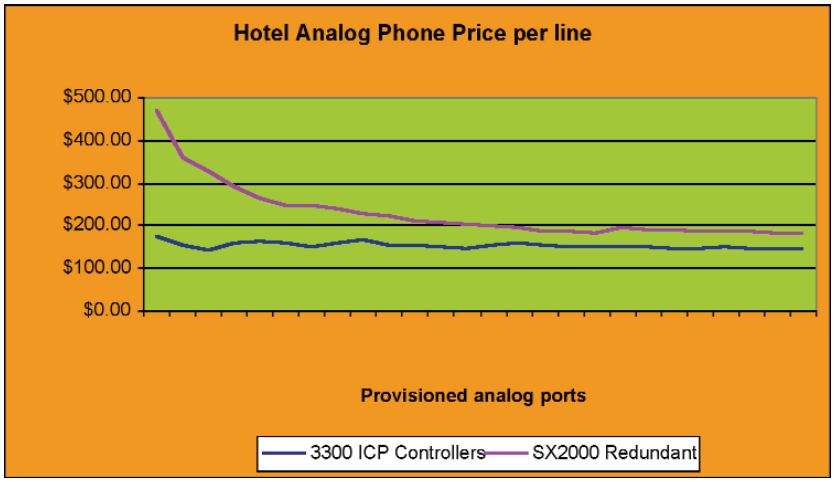

Figure 6: End-User Price per Line

These two graphs clearly show that in addition to the end customer getting a superior and future proof solution, they will also be paying less for it than if they purchased a traditional redundant PBX.

Conclusion

In summary, one of the concerns highlighted by the hospitality market is that the high availability solutions of traditional redundant PBX systems are not matched by the highly resilient IP telephony solutions.

A traditional redundant PBX would offer 5 '9's reliability which theoretically equates to 5.2 minutes unexpected downtime per year. In this scenario, the unexpected downtime would hit the entire hotel at the same time, no guest would be able to dial out, no wake-up calls would be delivered, and connection to the public network would be lost.

With Mitel's 3300 ICP solution, the effects of unexpected downtime can be greatly reduced:

- Multiple routes to the public network can be managed allowing the solution to bypass an unexpected failure to the 3300 ICP trunking gateway.
- Local AX Controllers mange their own wake-up calls such that any unexpected failure on the hospitality gateway does not effect pre-arranged wake-up calls.
- Local AX Controllers minimize any unexpected failure to a small percentage of the hotel's guests.
- A dedicated 3300 ICP hospitality gateway reduces the amount of contention between the solution and the front of house system.

Further Reading

This document has looked at the technical and availability position of a 3300 ICP solution. The next stage for the reader is to look at the full "Telephone System Availability" document, which much of the information within this document is sourced from. This document details all sections of the business continuity model and highlights different solution availability options.

The 3300 ICP Analog Solutions Technology Primer details the various different ways a 3300 ICP solution can be configured to deliver analog services. This document is available on Mitel OnLine.

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