PLANNING & IMPLEMENTING

VOICE over IP

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Introduction

Planning and implementing legacy voice systems is very much treated as plug and play due to their simplicity, robustness and maturity. Voice over IP on the other hand requires a different approach because of the completely different way voice traffic is handled and managed. Unlike legacy analogue systems, VoIP can result in packets being dropped, traffic becoming slower or not getting through at all, leading to a poor quality of service. As in when we speak voice traffic needs to be instantly received. Any latency problems will break up the voice pattern making it unrecognisable. We can tolerate small delays up to say half a second from servers down loading data files without noticing it but not with voice. Telephony is and always will be a critical part of any company's business and loss of the system or poor quality will affect business results. It therefore becomes essential to get it right first time as remedial work can be very time consuming to the detriment of the business as a whole.
This white paper attempts to provide guidance and advice when planning a VoIP system and looks at new technologies and how they can play a role from both a performance and cost perspective.

The First Steps

Before any planning can take place it is essential that measurements of voice traffic on the network are taken, when it peaks and which users create the most traffic. This should be spread over a period of time to capture changes in trends and is particularly important in call centres and the corporate enterprise where traffic is much higher with greater peaks and troughs.

This data will allow the system planner to design in the appropriate bandwidth to meet today's needs and capacity required for future growth as well as build resilience into the network where it's most volatile.

In addition to this it is also necessary to do an audit of the data network which should include metrics for latency, jitter and packet loss. Network latencies should not exceed 100 millisec and a maximum jitter of 40 millisec. Ideally packet loss should be zero although 1% is deemed acceptable.

The Planning Process

Identify where bottlenecks are most likely to occur and avoid them at all costs. The backbone of the system between switches is where most traffic is generated over and often where most problems occur due to traffic congestion. An extra 50% capacity should be planned for. For example where 2 fibre circuits are needed then an additional fibre circuit needs to be planned for in the event of an increase in traffic or one of the circuits going down.

Even with bottlenecks removed and resiliency planned in, problems can still occur due to latency. Switches and routers must be IEEE 802.1p compliant to ensure prioritisation of voice traffic over data. This should also include virtual LAN management from a central web browser. In the event of a port or blade failure the ability to drag and drop users onto a redundant back up is necessary where critical users are concerned.

Power Distribution & Management

The need to supply power to an IP phone provides the system designer with a new set of problems. Sites would normally have power cabling installed with AC adaptors supplied for the phones and apart from the additional cost of the adaptors there is now the issue of power management, especially where critical users are concerned. As comms rooms become increasingly burdened with high density blade and grid servers consuming lots more power, the need for management down to user level has become important.
Systems are expected to consistently achieve 99.999% uptime which means ensuring adequate power back up and network resilience to achieve this. Typical reports show that in an IT system failure which average between 10 and 20 per year:

- 90% of power outages are less then 5 minutes long
- 99% of power outages are less than 1 hour long

Since the IEEE released the 802.3af standard system designers have more choice and flexibility with the design of power distribution to IP phones and other powered devices such as wireless Access Points and IP security cameras.
The IEEE802.3af standard enables power to be distributed over standard Ethernet cables such as CAT5, CAT5e or CAT6 from either an end-span device such as a data switch to an IP phone. Power from the data port is injected onto the two unused pairs of the Ethernet cable which is connected to an Ethernet network card on the phone. This in turn picks up -48vdc thus negating the need for AC adaptors.
This is a very expensive option however as it means a forklift upgrade to existing legacy switches with 802.1p already built in.
A less expensive means is to deploy mid-span devices. These are sometimes known as powered patch panels as they sit between the 802.1p legacy switch and the IP phone. The data ports of the switch are patched into the mid-span device which in turn injects -48vdc onto the unused pairs. This approach means that legacy switches can be retained providing massive cost savings.
Mid-span devices can be managed down to port level from a remote web browser enabling ports to be turned off when unused or power to be apportioned according to device type e.g. 7 – 8 watts for an IP phone or 13 – 14 watts for a wireless Access Point.. This telemetry optimises power and cost management.
Back up is supplied by a UPS to each mid-span saving on having to supply back up individually to each IP phone.

Deployment

There are different types of installations which support VoIP and each has its own merits. Where VoIP is being rolled out on an existing site it is advisable to do a trial test on a pilot installation in order to evaluate the performance of the system and its components such as the PBX and data switches. This should be done in parallel with the existing circuit switched PBX to compare performance. Multi-pair voice grade cables in the backbone should be replaced with either copper or fibre cabling capable of supporting the bandwidth for the required data thru-put. It is recommended that CAT5e copper cabling as a minimum grade should be installed to the desk to support the new system as this will support Ethernet LAN Speeds up to1 Gigabit. CAT5e or OM3 fibre should be installed in the backbone subject to individual LAN requirements.
The pilot site should accommodate approx 30 users to begin with and scale upwards as system performance expectations are met. These users should be non-mission critical to reduce levels of risk in the event of failure.

Summary

The true cost benefits of VoIP will be realised sooner with good upfront planning and a robust process.
Building a network which meets current as well as future expectations requires knowledge of how the system is performing today and providing enough capacity to cope with future growth.
Managing network traffic is essential to ensure QoS expectations are met. Backup needs to be provided in the event of failure.
Other benefits come with new products which provide improvements to power distribution and management down to user level as well as additional cost savings.
Network cabling needs to be of a suitable standard which supports existing LAN traffic and future bandwidth projections.
System upgrades need to be benchmarked against existing PBX performance levels and a small pilot site installed to reduce risk.
Sticking to these basic procedures will reduce the level of risk, increase the likelihood of getting it right first time and provide a faster ROI.

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