Mission Critical Audio Conferencing with VoIP

An XOP Networks White Paper

What's Inside

EXECUTIVE SUMMARY

Mission Critical Audio Conferencing is typically used in applications such as:

- Air Traffic Control
- Satellite Launch Control
- Air Force Command & Control

Most of the systems that are currently deployed in the field today were developed in eighties and nineties and hence are TDM[1] based. VoIP based packet networking has matured significantly in the last decade.

According to several research analysts, shipments of IP PBXs have out stripped the shipments for legacy TDM PBXs. Similarly, VoIP based value added services platforms such as conference bridges are also available from multiple vendors.

Given this backdrop this paper discusses how mission critical conferencing can benefit from VoIP based packet networking. Also, mentioned are lessons learnt from an actual deployment of VoIP based mission critical conferencing application at a large satellite launch services company.

The net result of the new VoIP technology is to give significant CAPEX (up to 50% less), and OPEX savings (up to 40% less). The overall system is significantly more reliable and has inherent flexibility that can be engineered to customer requirements. The network also benefits from the low cost CPE that come with VoIP networks.

[1] TDM: Time Division Multiplexing

ISSUES WITH LEGACY MISSION CRITICAL CONFERENCE SYSTEM

Figure 1 shows a typical legacy mission critical conferencing network.

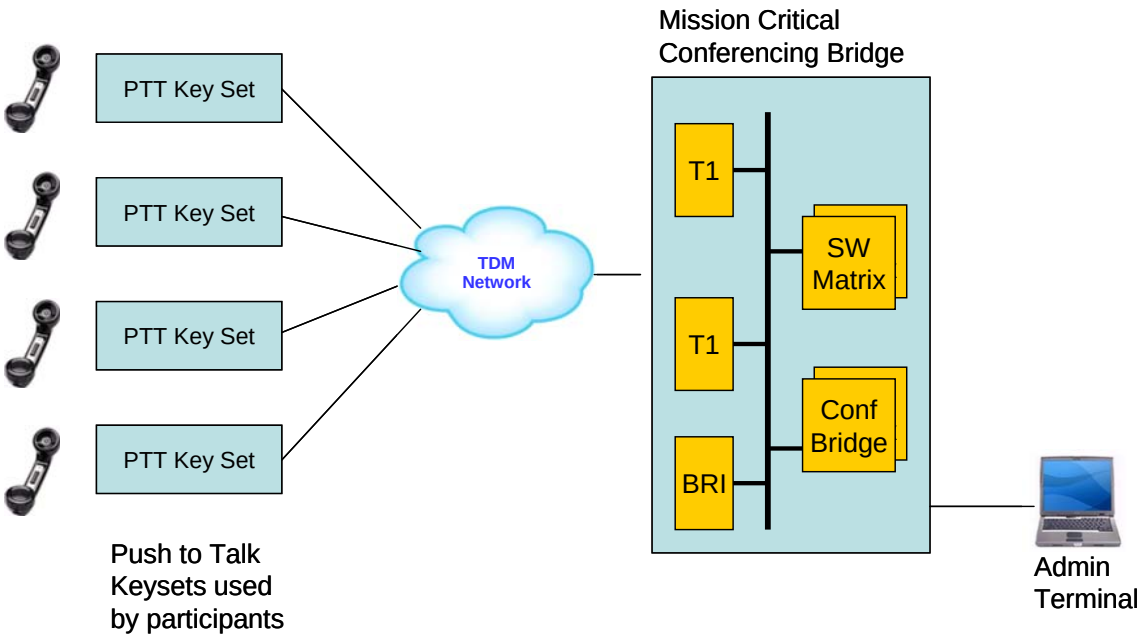

Figure 1: Legacy TDM based Mission Critical Conferencing Network

The legacy mission critical conferencing networks are built using TDM based conference bridges and TDM based Keysets as shown in Figure 1. The Keysets are connected to the Bridge using redundant leased phone lines. Typically the Keysets are wired into the headboard of the participant's desk. By pressing mechanical push button key's the participant is able to dial into the selected conference call. Then using the PTT handset, the participant is able to speak into the conference as needed. Functionally, the network serves its purpose but has several issues with it as mentioned below:

MONOLITHIC ARCHITECTURE - EXPENSIVE APPROACH TO HIGH AVAILABILITY

The current implementation of Mission Critical Conference Bridges is monolithic in nature. Such systems use proprietary signaling between its different sub-systems. All critical components are duplicated and sometime even triplicated to meet the five 9's availability requirement adding a lot of complexity and additional hardware that ultimately increases the size, power and ultimately to the cost of such equipment.

TECHNOLOGY OBSOLESENCE

The current Mission Critical Conference Bridges were developed in eighties and nineties. The prevalent technology available to vendors during that time frame was mainly Time Division Multiplexing (TDM). Hence majority of the Mission Critical Conference Bridges deployed today are built with expensive TDM based building blocks. These products have no path forward for adding newer technologies such as VoIP, Presence, Instant messaging etc.

PROPRIETARY SYSTEM

The current Mission Critical Conference Bridges also use proprietary signaling between their Keysets and the main Mission Critical Conference Bridge unit. The net result is that a customer has to buy the entire network from the same vendor limiting innovation and requiring new feature requests to be determined by vendor's timeline instead of an end customer's need.

MECHANICAL FAILURES ON KEYSETS

Legacy Mission Critical Conference Bridges work hand-in-hand with mechanical push button based keysets. Due to normal wear and tear, such devices eventually will have mechanical failures. Usually, spare seats are set up in a NOC that can be used in case of such failures which also adds to the overall expense.

IP BASED MISSION CRITICAL NETWORK IMPLEMENTATION

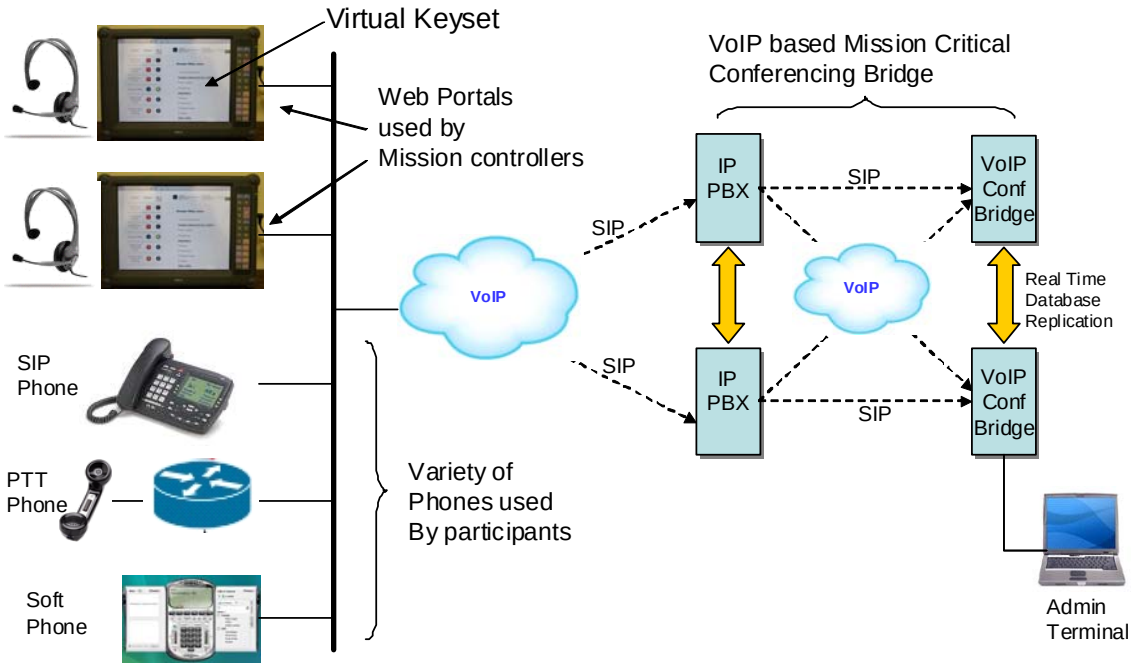

Figure 2: VoIP based Mission Critical Conferencing Solution

The Figure 2 shows a VoIP based Mission Critical Conference Bridge network. It comprises of a pair of primary and secondary hot standby IP PBXs and a pair of primary and secondary hot standby VoIP based audio conference bridges. The databases of each pair is replicated and kept in sync in real time. The voice traffic from the PSTN, from remote locations (handsets connected to voice gateways/routers) and variety of SIP phones is dual homed to both IP PBXs.

Under normal operation, all the VoIP traffic is handled by the primary IP PBX and the primary VoIP Bridge. In case of a network outage or failure of the primary IP PBX, the traffic is automatically routed to the secondary IP PBX. In this case, the secondary IP PBX will continue to send the conferencing traffic to the primary VoIP Bridge.

In the event the primary VoIP Bridge is also not available, then the traffic will flow to the secondary VoIP Bridge. As the failed network elements are restored the traffic automatically moves back to the primary route. This network architecture is analogous to the packet based SS7 network that is used for signaling between network switches and is one of the most resilient telephony networks in the world.

THE VIRTUAL KEYSET

Figure 3 shows a virtual Keyset. It supports a command and control web portal. It also provides a softphone that is used to call into the mission critical conference bridge.

The virtual Keyset is dual homed to both primary and secondary hot standby IP PBXs. In the event, due to any networking issue, the soft phone looses connectivity to the primary IP PBX, it will automatically try to register with the secondary IP PBX. This extends 'high availability' coverage to the soft phone imbedded in the virtual Keyset itself.

The Command and Control web portal allows an operator to join a given conference based on a web click or just by touching the screen (in case the monitor supports touch sensitive screen). As there are no mechanical keys involved, this command and control system is immune from any mechanical failures.

The use of a softphone coupled with the command and control portal improves the availability figures for the overall network.

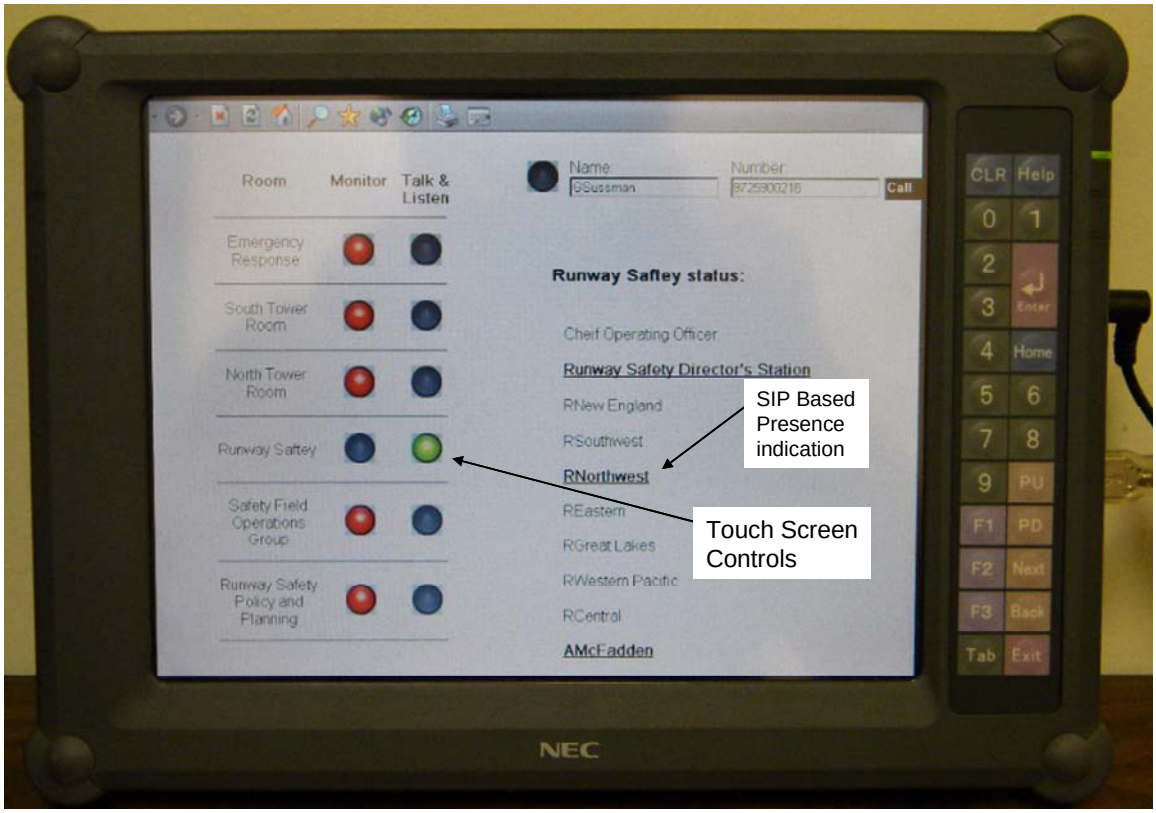

Figure 3: A Virtual Keyset

The command and control portal allows the mission controllers to see participants that are associated with different rooms, those that are available to take calls based on 'presence' information and those that are actively talking based on loudest speaker algorithm. The mission controllers are also able to monitor the audio from multiple rooms simultaneously and barge in to a given room simply by touching appropriate buttons on the screen.

BENEFITS OF VOIP BASED MISSION CRITICAL CONFERENCE BRIDGE

There are several other benefits to the VoIP based mission critical conferencing solution.

DISTRIBUTED ARCHITECTURE - SCALABLE HIGH AVAILABILITY

With the monolithic approach, the high availability number is fixed and is a function of how redundant individual components are. With the VoIP based distributed approach, one can engineer the level of availability needed by adding multiple IP PBXs and multiple VoIP based bridges as required.

LOWER COST OF CAPEX

Because the bridges use standard industrial grade hardware (with redundant PSUs, Disks and CPUs etc), and the operating system is Linux based, the capital cost is significantly reduced, typically less by up to 50% when compared to legacy TDM solutions. The Linux based software also permits rapid feature development, that again reduces initial and subsequent feature development costs.

LOWER OPEX

The legacy TDM based approach requires an organization to have dedicated leased lines between their geographically dispersed CPE devices and their TDM based Mission Critical Conference Bridge. Some times these lines are extended to different parts of the world. Given the mission critical nature of the usage, these lines are usually redundant. Since events needing use of mission critical conferencing, e.g., a satellite launch, do not occur on daily basis, this leased line approach becomes expensive quickly.

These days most of the organizations that need mission critical conferencing have installed their private data networks (MPLS, MetroE etc.). Inherent within such packet networks is the ability to create virtual circuits and allow such circuits to be used for alternate routing. These virtual trunks obviate the need for redundant physical trunks as is the case with legacy approach and that leads to significant OPEX savings.

The bridge servers use power much more efficiently compared to the monolithic switch counterpart, as power is used only when needed instead of keeping the spare modules powered up at all times. The power estimate for the two IP PBXs and two VoIP bridges as shown in Figure 2 is approximately 1000 watts as opposed to 5000 watts associated with the monolithic Mission Critical Conference Bridge. Reduced power also results in lesser cooling required to operate the equipment.

VENDOR AGNOSTIC

The network elements comprising the distributed Mission Critical Conference Bridge are standard products that are available from multiple vendors. These products follow the demand and supply cost curve typical of any standard product. So as time progresses this approach will yield an overall lower cost of ownership.

Also, being standard products, there is no need for any proprietary signaling between them. This helps the organization as it is not dependent on a single vendor for the entire solution.

GEOGRAPHICALLY REDUNDANT DEPLOYMENT, REMOTE OAM&P

The IP PBXs and VoIP based Conference Bridges can be located at different geographical locations, further improving the overall availability of the network. The administrative web portal of any of the servers can be accessed from any PC (with proper authentication) connected to the Internet. This provides a lot more flexibility in managing OAM&P[2] functions associated with the equipment compared to the legacy approach where the Mission Critical Conference Bridge can only be managed from a co-located administrative terminal.

REMOTE TROUBLESHOOTING AND NETWORK ASSURANCE TESTING

Even though the individual network elements support five 9's of availability, they need to be tested and re tested to make sure that they are working optimally and are available when the actual need occurs. In the legacy TDM environment, test engineers make routine test calls to make sure network is operating end to end. In case of any issues, a lot of manual testing is used until the equipment is restored back into service.

With VoIP approach, the network tester can be more proactive. By using automated test tools network testers can learn about the health of the equipment and various interfaces before the equipment gets into a failed condition. Being able to take proactive action easily further improves the availability of the network.

PRESENCE

The VoIP network uses Session Initiation Protocol (SIP) for signaling between different network elements. This signaling format has built in processes that make use of 'presence' information. Incidentally same SIP signaling is used on Instant messengers that allow one to see if their buddy is online or not. Use of SIP allows VoIP based mission critical conference network operators to invite other operators and/or colleagues into a conference based on their 'presence' status.

PHYSICAL SIZE

Each one of the IP PBXs and the VoIP based bridges as shown in Figure 2 are built using 1RU high servers. So all four units comprising the VoIP based Mission Critical Conference Bridge can fit into a 4RU (about 7 inches) vertical shelf space. The equivalent monolithic Mission Critical Conference Bridge requires a 7 ft Telco cabinet. Therefore, the VoIP based approach provides equivalent functionality but in a considerably less space.

[2] OAM&P - Operations, Administration, Maintenance and Provisioning

CONCLUSION

Mission critical conferencing equipment plays an important role in situations where decisions made could affect the lives of thousands if not millions of people. It is extremely important that such equipment be always available when needed. So far this need had been met by very expensive monolithic mission critical conference bridges that are TDM based.

As most of the telecommunications networks are migrating from TDM to VoIP, same is true for the mission critical conferencing networks as well. The VoIP solution has significant CAPEX and OPEX cost savings that can easily justify the network upgrade.

This paper examines the architecture of a VoIP based mission critical conference network and points out the benefits of VoIP based approach vis-à-vis the legacy TDM architecture.

XOP Networks has broken new ground in this area. It has developed VoIP and TDM based mission critical conference bridges that can be used with an organization's legacy TDM assets (keysets, PBXs, voice gateways etc.) and its VoIP resources such as MPLS network, IP PBXs etc. Its mission critical conferencing gear is currently deployed in world's largest commercial satellite launch services provider's network.

ANNEX 1 FEATURE SET FOR XOP NETWORKS' MISSION CRITICAL CONFERENCE APPLICATION

The following feature set summarizes the capabilities of the XOP Networks' Mission Critical Conference Bridge.

SUBSCRIBER FEATURES

- Use soft phone to dial into a mission critical conference
- Use a web portal for monitoring multiple on going conferences simultaneously
- Use a web portal to barge in and have full duplex access to a conference
- Visually detect voice activity in active conference rooms
- Display loudest speaker
- Display participants that are associated and available to participate in a conference based on 'presence' information
- Allow a mission controller to use the web portal to dial out to outside PSTN numbers and pull people into a conference

SYSTEM FEATURES

- High availability - 99.999%
- Asymmetric bridge architecture with 'n' network facing ports and 'm' conference resources, where m > n (CJB) I don't understand the point here
- Record all mission critical conference calls
- Allow multiple virtual mission critical bridges inside one bridge
- Military grade security (JITC compliant Information Assurance)

Want to Learn More?

For more information, please visit our Web site http://www.xopnetworks.com or send an email to marketing@xopnetworks.com

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About XOP Networks

XOP Networks, founded in 2002, is a leading supplier of TDM and IP based value added services platforms for Enterprises and Independent Telephone Companies. Its unique product architecture allows smooth migration of value added services from legacy circuit switched TDM networks to VoIP based packet networks. Its products support Audio Conferencing, Web Conferencing, Mass Notification, Enhanced Firebar, Voicemail and a few other services. XOP Networks is headquartered in Plano, Texas.