Datatek

Solutions

MIGRATION STRATEGIES

FOR BNS-2000 NETWORKS

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INTRODUCTION

The telecommunications industry is witnessing a period of profound change, stimulated by the coinciding impacts of innovative new technology and global de-regulation - an environment that offers unprecedented growth opportunities. One result is that new entrants to the business (part of what has come to be called the “new economy”), who have the advantage of being able to build up their infrastructures “from scratch”, have been able to achieve significant market presence, if not dominance, seemingly overnight. The challenge for established service providers as well as enterprises, therefore, is to find cost-effective ways to consolidate and migrate their infrastructures and operations so that they too can take full advantage of the productivity benefits offered by the newer technology, without jeopardizing the service their users expect and depend on.

Telecommunications carriers are by their nature widely dispersed operations, as are many large enterprises. This has forced them to deploy Wide-Area Networks (WANs) to connect large numbers of remote sites with centralized work centers, using the best available technology. Today, the popular model for many business operations being conducted over a wide area is the corporate “intranet”, based on the same Internet Protocol (IP) technology that has driven the explosive growth of the worldwide Internet. At the same time, more robust technologies such as Asynchronous Transfer Mode (ATM) and Frame Relay, themselves used in the core of the IP infrastructure, are also available as direct interconnect options. While the new entrants to the business have the luxury of quickly building infrastructures using these technologies, established carriers and enterprises are faced with the requirement to more gradually migrate to them from a base of older technology. These older technologies. although now viewed as limited in terms of scalability and increasingly difficult to maintain, have nevertheless, in many cases, proven themselves to be highly reliable over long periods of time. Lucent Technologies’ BNS-2000 product family represents one of these proven technologies.

Lucent's BNS-2000 product family has been successfully utilized as a reliable WAN infrastructure element supporting the internal operations of many carriers and enterprises for more than a decade. Much of its success can be attributed to its flexibility in being able to support a diversity of applications utilizing many different protocols, with high reliability. In 1998, Datatek Applications was formed for the purpose of developing strategies for BNS-2000 users to move to newer technologies. After consulting with many large BNS-2000 users to gain a better understanding of their present and future needs, Datatek Applications has developed a portfolio of new products based on the general theme of offering a smooth migration path from BNS-2000 based infrastructures to networks based on the newer technologies mentioned above.

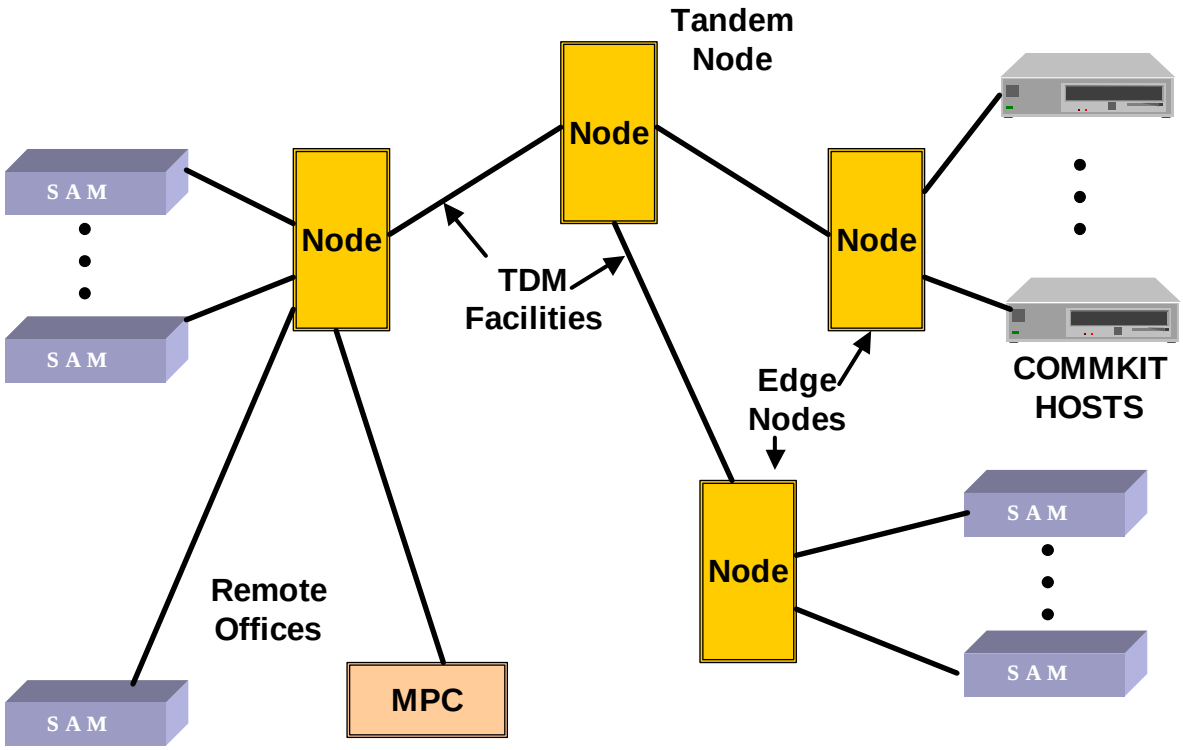
In addition to developing these products, Datatek Applications has worked closely with specific BNS-2000 customers to help them plan their individual migration strategies. Based on what has been learned through those collaborations, this document suggests a sequence of migration steps that are appropriate for a typical BNS-2000-based Operations System Data Network (OSDN). The migration strategy seeks to achieve two objectives – have positive economic value at each step, and cause absolutely minimal disruption to users as it proceeds.

This is the master in a Datatek Applications Solutions Documents series. The other documents provide more in-depth technical information pertinent to each migration step, and are referenced as required.

A CLASSIC LEGACY BNS-2000 NETWORK

When talking about migration, a simple model would be useful as a starting point. The classic legacy BNS-2000-based OSDN, represented by the diagram below, has an infrastructure typically made up of tandem and edge nodes connected by TDM trunks ranging in speeds from 64 Kbps to 45 Mbps. In the remote CO sites, a variety of SAMs and MPCs provide the legacy interfaces needed to support the Network Elements. The SAMs and MPCs are linked to the edge nodes typically via sub-T1 rate links. In the OS

data center site, application hosts connect to the BNS-2000 nodes via legacy protocol modules or through multiplexed fiber interfaces (CommKit®). The BNS-2000 network elements are managed by the StarKeeper® II NMS system, which uses the proprietary multiplexed fiber interface to connect to the BNS-2000 network that it manages.



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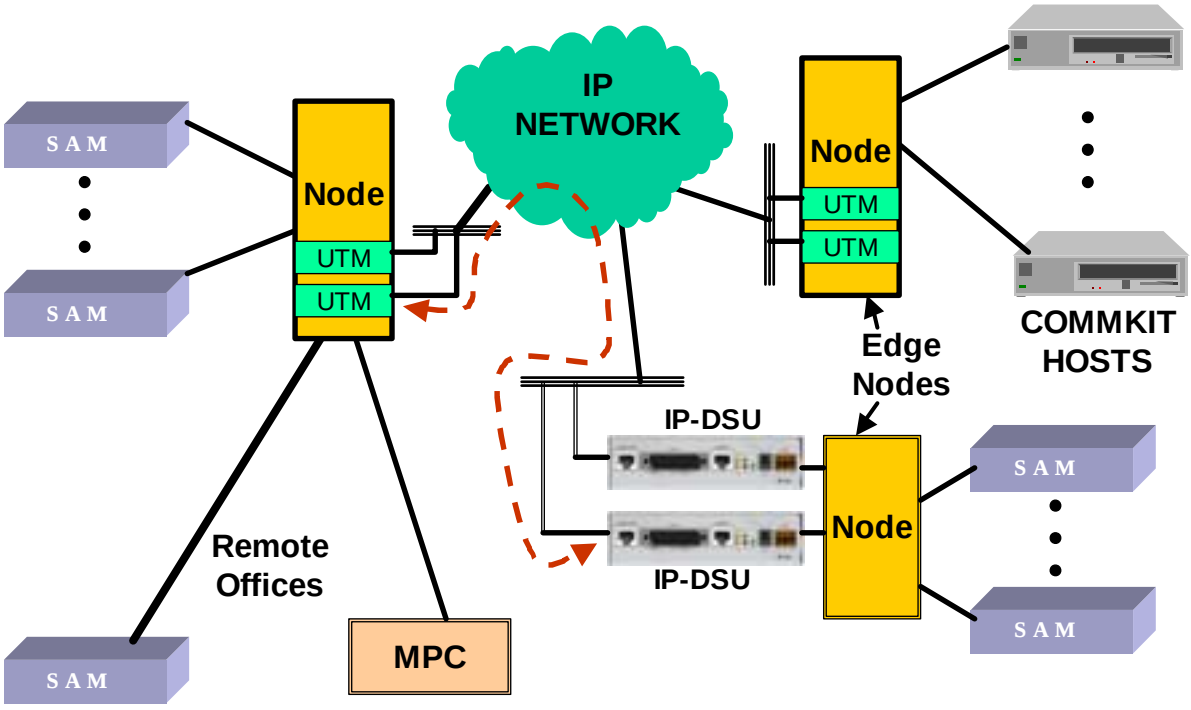
AN OVERLAY SOLUTION FOR THE NETWORK CORE

The ***overlay*** solution to be discussed as a first migration step presumes the existence of a parallel internal IP network made up of LAN segments, routers, and WAN facilities interconnecting sites. Like the BNS-2000 network, the IP network has its own operations and maintenance staff, equipment spares, addressing and security rules, etc.

Integrating the two networks into one to lower costs is obviously a great long-term goal, but certainly can't be completed overnight. To minimize re-training requirements as well as the impact on ongoing operations and current administrative responsibilities, a reasonable first step would be to begin using the IP infrastructure to carry the BNS-2000 traffic currently carried by the inter-nodal private-line TDM trunks. This preserves the logical structure (trunking and concentration) of the BNS-2000 network, so it's transparent to users. It also allows administrators of the two networks to continue working more or less independently, so it minimizes organizational impact as well.

The solution document ***WAN Facility Consolidation in BNS-2000 Networks*** discusses the use of the **IP-DSU** and **Universal Trunk Module (UTM)** products in an ***overlay*** solution, which will eliminate some of the private-line TDM facilities that were seen in the previous diagram while continuing to use the same node, SAM, and MPC equipment. The next diagram shows the new configuration.



Notice that the tandem node has been eliminated. Because the IP infrastructure is being used as the network core, there is no longer any need to converge traffic into a tandem node. In this fully-connected network without the tandem node, each node is required to have two trunk terminations, either **UTM**s or legacy trunk modules with external **IP-DSU**s, but now, both trunks share the same facility – the IP LAN at each node site. Some of the trunk modules which were previously resident on the tandem node may now be re-used in edge nodes which are using **IP-DSU**s**.**

For the purpose of this migration discussion, the **UTM** and **IP-DSU** were treated as interchangeable. However, readers of the above-referenced solution document may recall that the **UTM** offers certain capabilities not available with an **IP-DSU**. The **UTM** allows BNS-2000 traffic to be overlaid onto an IP, Frame Relay, or ATM infrastructure, whereas an **IP-DSU** works only with IP. Also, when multiple infrastructures are accessible (one must be IP), a pair of **UTM**s can provide duplex trunking for higher

reliability. Finally, the **UTM** supports a priority queuing algorithm (by emulating the legacy TRUNK-PQ), which is beneficial whenever congestion is anticipated in the core infrastructure. When point-to-point traffic volume is asymmetric, a **UTM** would be required for priority queuing only in the node sourcing the larger volume of traffic, as can be seen in the previous diagram.

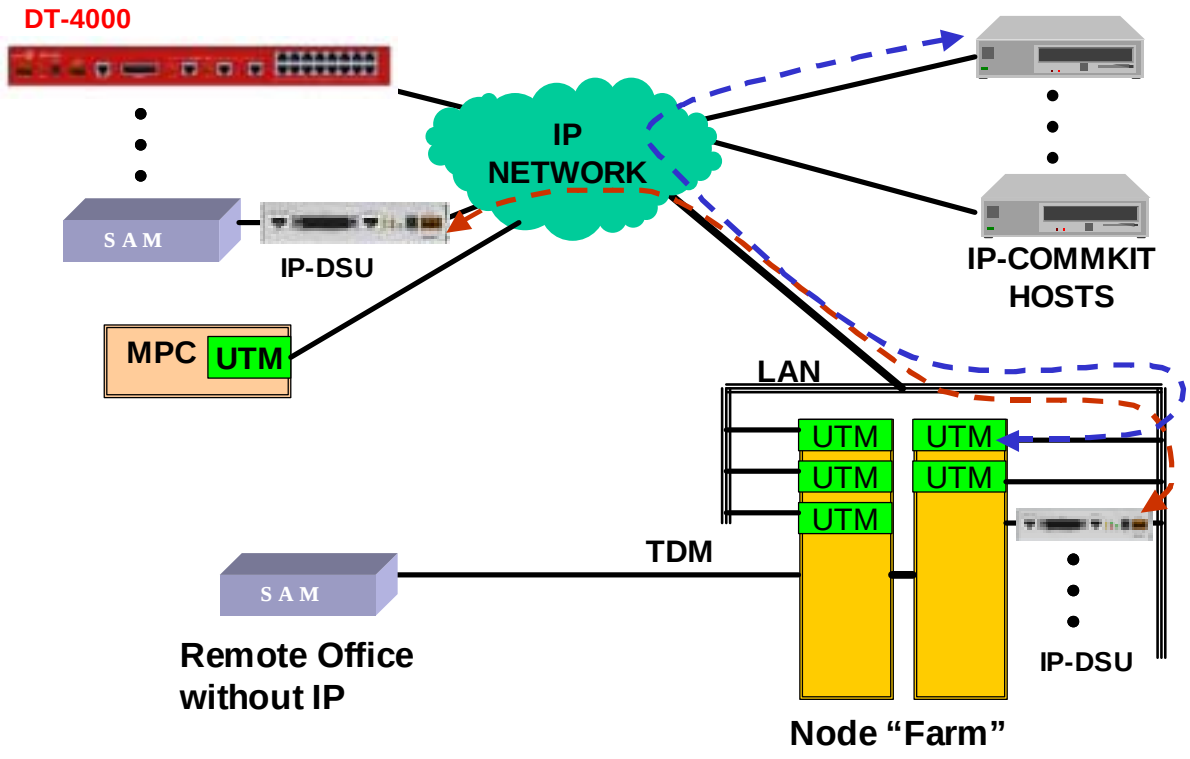
Many BNS-2000 network operators have already taken this step and have realized substantial cost savings due to the private-line elimination. An additional advantage would result if the private lines were leased from another carrier who may even be a competitor – now this mission-critical traffic can be carried over the in-house IP network instead.

OVERLAY SOLUTION FOR THE PERIPHERAL INFRASTRUCTURE

The next logical step in the migration process would be to move the links to the peripheral interfaces onto the IP infrastructure. Existing SAMs can use **IP-DSU**s to eliminate their private-line connections back to the node. Optionally, a **DT-4000** can replace an existing SAM, since it has built-in **IP-DSU** functionality. An MPC can use either a **UTM** or **IP-DSU** for its trunking interface to the IP network. Offices without IP access must remain connected via TDM circuits.

At this point, it would be appropriate to also consider the use of **CommKit over IP**. This is a software-only product that allows the distance-limited fiber between a BNS-2000 node and a CommKit host to be replaced by a generic IP connection (a **UTM** is required in place of the CPM in the node). This meshes well with the overlay strategy – application software, as well as users elsewhere in the network, can continue to access the same CommKit services in the same way. The advantages of using **CommKit over IP** are that a standard Ethernet interface can now be used in place of the specialized CommKit hardware, and the fact that there is no need any longer to have to co-locate a BNS-2000 node with the CommKit host.

As the next diagram shows, a node "farm" has been created to co-locate the nodes that are still needed. They contain the **UTM** or **IP-DSU** terminations for SAM, MPC, or **DT-4000** trunks overlaid onto the IP infrastructure, **UTM** terminations for **IP-CommKit** hosts, host any required DKAP applications, terminate TDM circuits from offices which do not have an IP presence, and other useful functions. By locating the nodes together (optional of course), network maintenance becomes easier.



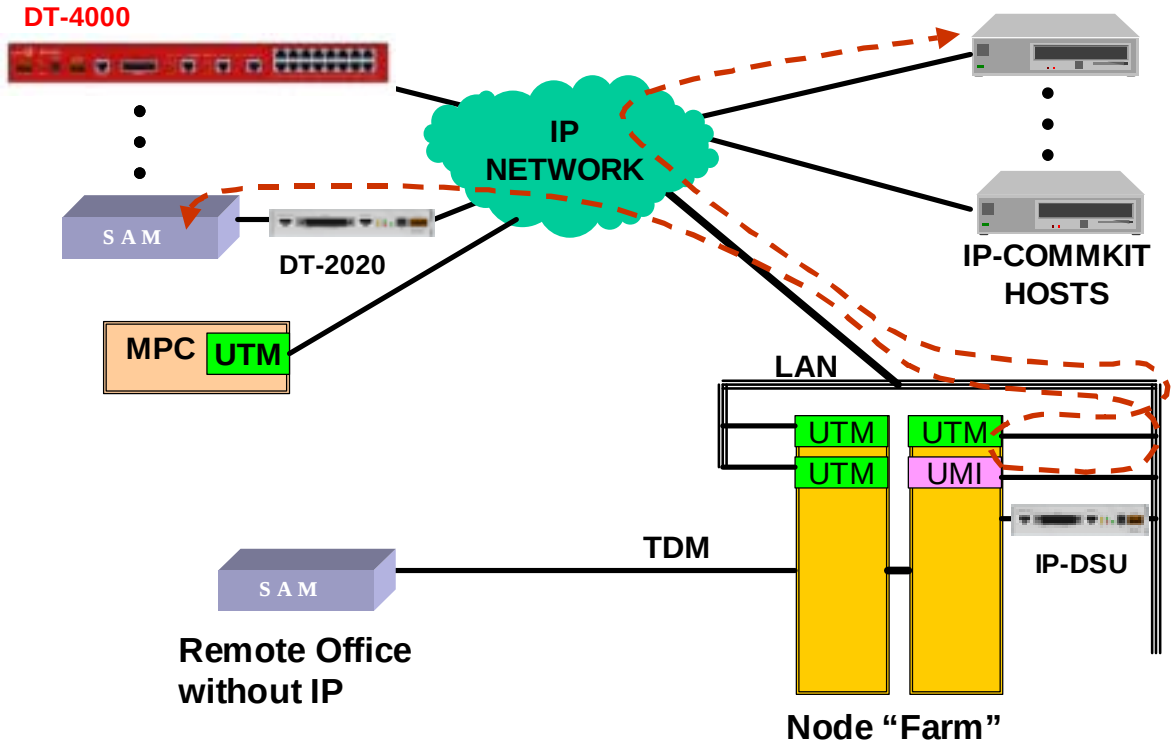
As many private-line connections as possible have been eliminated as well as some SAM and/or nodal equipment. The network now looks a lot different than when started the migration process was started, but it's important to note that the users still have the same services they have always had. The same addressing, security, and other aspects of the BNS-2000 network have been preserved, because the IP and BNS-2000 networks are still logically separate entities.

MEDIATION AND NETWORK INTEGRATION

As just discussed, there are very definite benefits to be realized from overlay solutions, but at least from the operations point of view, there are still have two distinct networks. In the longer term, these networks may want to further integrated to maximize the productivity of both users and network operators, as well as to be able to consolidate and/or retire aging equipment. In certain cases, described below, more immediate and tangible economic benefits may also result from moving beyond simple overlay constructs.

The solution document ***BNS-2000/IP Network Integration Strategies*** gives an in-depth description of Datatek Applications' ***mediation*** technology, and illustrates the use of some specific products. Readers of that document will probably recall that individual – or all – ports on a **DT-4000** can be re-configured to act as "IP ports", meaning that devices connected to such ports can now directly communicate with other devices on the IP network (possibly requiring a protocol translation device, as discussed later on). This is an easy first step towards network integration, since any existing **DT-4000**s are probably already physically connected to the IP network, working in "**IP-DSU** mode". Also, for each SAM, replacing its **IP-DSU** with a **DT-2020** places all of its ports on the IP network (and eliminates the need for an **IP-DSU** or **UTM** termination in the node "farm").

After taking the above steps, there is now a set of users/devices that can now communicate with each other over the IP network instead of the BNS-2000 network. They can also now communicate with "native" IP devices, such as LAN-connected PCs or servers, but they're now isolated from users still on the BNS-2000 network, such as CommKit hosts (either fiber or IP connected), SAMs still connected via **IP-DSU**s or TDM trunks, and other MPC or node ports. To remove that constraint, a **Universal Mediation Interface (UMI)** placed in one of the remaining BNS-2000 nodes can act as a gateway, allowing devices on the two networks to communicate with each other as needed, on a call-by-call basis. This is shown in the following diagram.



The diagram above shows the network after it has begun to integrate its IP and BNS-2000 operations. The path shown in red represents a call that has been established between a SAM port (now on the IP network) and a CommKit host (still logically on the BNS-2000 network though connected via IP). Notice that there are now fewer **UTM**s and **IP-DSU**s in the node “farm”. This is because many of the SAMs have their ports now operating directly over the IP network (by using **DT-2020**s) and some **DT-4000**s may have had all their ports reconfigured to IP (although this is not mandatory – a **DT-4000** can continue to support a mix of IP and BNS-2000 ports over its single 10BaseT interface).

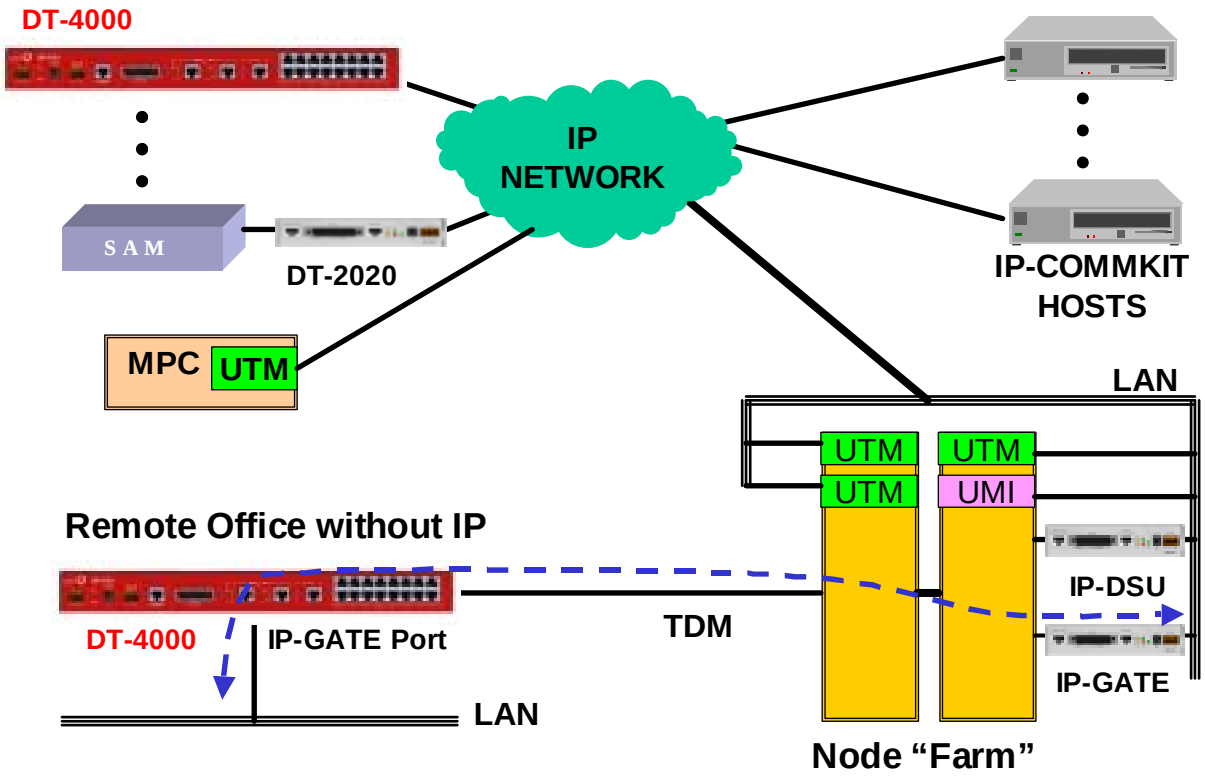
It should be very apparent that a big step was taken when the two networks were tied together in this fashion – allowing connectivity between users on the two networks. Much more coordination will be required between administrators of the two networks

(assuming they are still different people), to insure addressing consistency, establish closed user groups for access security, monitor traffic, etc.

Although it is recommended as a general rule that BNS-2000 network operators begin their migration process with overlay solutions because of their relative simplicity, there is at least one situation where it would be more attractive from an economic standpoint to use the mediation (network integration) approach at the outset for at least a subset of the network. Since a single **UMI** can support up to 504 simultaneous sessions, it can act as the termination point for 31 **DT-4000**s (each having 16 ports), 63 SAM-8s, or other large mixes of SAMs and **DT-4000**s, which would require equivalent numbers of **UTM**s or other trunk modules, as well as the nodes to continue to host them, in an overlay solution. Therefore, for large networks, cost comparisons of equipment requirements of both overlay and mediation solutions should be made to see if there is a large-enough cost savings from using a **UMI** as a “multi-SAM trunk”.

NON-IP REMOTE OFFICES

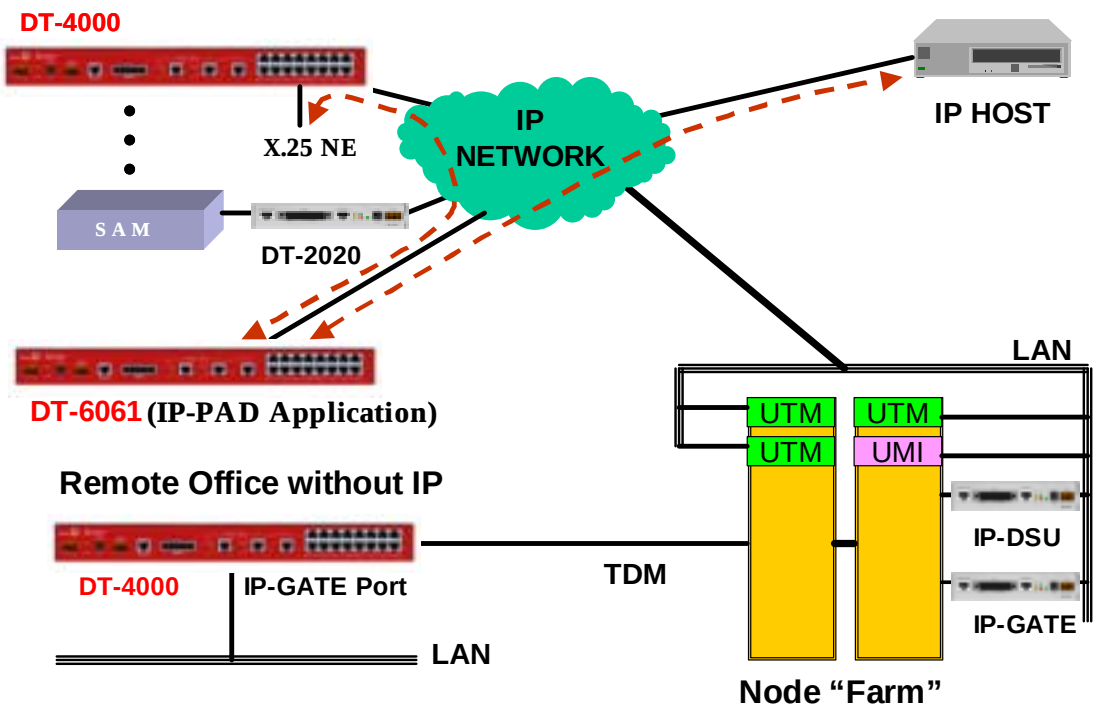
There may still be sites that do not have access to the IP infrastructure. If, as in the previous diagram, an office already has a BNS-2000 presence (i.e., SAM, MPC, or node), Datatek Applications offers a simple way to provide IP access in that office if and when it is needed. As discussed in the solution document ***Secure and Reliable Intranet Access For Remote Sites***, an **IP-GATE** can be used with any SAM port to provide IP access through a BNS-2000 network. As an alternative to consolidate equipment, a **DT-4000**, which has a dedicated port providing an integrated IP-GATE function, could be used as a SAM replacement. This is shown in the next diagram.



As the above diagram shows, a peer **IP-GATE** is required at the node "farm" to terminate the "IP over BNS-2000" connection to the remote office. Any native IP device connected to the IP-GATE port on the **DT-4000** in the TDM-connected remote office (directly or via a distributed LAN segment) would now be able to access users anywhere else in the corporate IP network. For large numbers of remote offices to be supported in this fashion, Datatek provides **IP-FANOUT** software for either DKAP or an embedded network processor (discussed next), which requires only one IP-GATE in the node "farm".

MIGRATING PROTOCOL-SPECIFIC EQUIPMENT

Finally, to eliminate MPCs with specialty (protocol-specific) modules from the remote sites, higher-layer protocol functions can centralized in an embedded network processor, which can be located anywhere there is access to the IP infrastructure. Since practically any device can interface with **DT-4000** or **DT-2020**/SAM ports, embedding a **DT-6061** network processor, as shown in the next diagram, allows these lower-cost generic ports to take the place of ports in protocol-specific modules in MPCs. After taking this step, there will be specialty modules only in the node "farm", if at all. For more information on the uses of the **DT-6061** embedded network processor, including a more detailed discussion of the IP-PAD application indicated in the diagram, please see the solution document ***BNS-2000/IP Network Integration Strategies***.



NETWORK MANAGEMENT CONSIDERATIONS

All the new Datatek Applications products discussed in this document have been designed with several different network management options. Each has an RS-232 console interface which provides an ASCII-based user interface which can be used for configuration, performance monitoring, and diagnostics, either directly or via StarKeeper II NMS. Rather than using this console port, the same functions can be accessed over the IP network via a TELNET session. In addition, they incorporate an SNMP agent and appropriate MIB variables. They report faults via StarKeeper-compatible alarms as well as SNMP traps. Therefore, as these products are introduced into the network, they can be managed as part of either the BNS-2000 or IP management infrastructure, or a combination of both.

Datatek Applications supports the migration of StarKeeper NMS itself through its **SKweb** product. This allows StarKeeper to be upgraded to act as a Web server, so a PC client anywhere on the IP network can access StarKeeper network management data and applications using a standard web browser. As a result, the management of legacy BNS-2000 network elements can be more easily integrated with the broader corporate network management infrastructure. For further information see ***Skweb Installation and User Manual.***

CONCLUSIONS

Datatek Applications has developed a family of products intended to allow existing BNS-2000 networks to migrate towards newer networking technologies and/or operate at lower cost. This document has proposed a series of incremental migration steps applicable to a typical BNS-2000-based OSDN, which apply these products. At each step in the process, there is positive economic benefit and minimal disruption to users. It is hoped that this document can serve as a starting point to orient potential migration customers, which can be followed up by contacting Datatek Applications through your sales representative for a closer examination of their specific configurations and needs and assistance in the development of an appropriate migration plan.