MANAGING EMERGING TELECOMMUNICATIONS TECHNOLOGIES FOR COMPETITIVE ADVANTAGE

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INTRODUCTION

Telecommunications service providers and equipment vendors today face significant challenges as they address the multitude of changes and competitive challenges sweeping their industry. Networks are increasing in size and complexity as demand pressures grow and as new technologies — from wireless communications and fiber optics to multimedia, computers and advanced Internet technologies converge upon the network. As the competitive environment intensifies, it becomes increasingly important for service providers and equipment vendors to be able to react to changes quickly and effectively while maintaining the highest levels of performance and reliability.

One of the most important means of achieving these goals is the ability to efficiently model, manage, and optimize the next generation of telecommunications equipment and services. Telecommunications networks are among the most demanding environments in terms of performance and reliability, and as a result place enormous demands on the database management systems that are at the heart of most telecommunications equipment and services. The next generation of telecommunications applications requires a new generation of database technology - technology that draws on the strengths of priorgeneration DBMS technology and blends them with the latest software advances; a DBMS designed from the ground up for the highest performance and reliability in concurrent, highly distributed, multi-platform environments with extremely large data storage requirements. The Versant ODBMS (object database management system) is such a product. Versant is a seventh generation DBMS combining the direct modeling of complex, graph/structured data with the power of today's leading object programming languages combined with report oriented query capabilities. From its inception, Versant has been architected to achieve the highest levels of performance and reliability in concurrent, highly distributed, open systems environments, and to maintain them 24 hours a day, seven days a week (24 x 7). As a result, the Versant ODBMS allows telecommunications service providers and equipment vendors to solve problems that they have been unable to solve using older storage technologies.

The Versant ODBMS is being used today in many important telecommunications applications including:

- Integrated Digital Loop Carrier (IDLC) Management
- ATM/SDH/SONET Element Management
- Advanced Intelligent Networking (AIN)
- Adjuncts and Intelligent Peripherals
- Head Office Collectors and Billing Systems
- Operational Support Systems
- Inter-Service Provider Electronic Bonding
- UMTS - Universal Mobile Telecom Systems

Because of the strength of the Versant architecture and its ability to reliably handle complex data structures and relationships in a concurrent, highly distributed environment, dozens of telecommunications companies worldwide have Managing Emerging Telecommunications Technologies for Competitive Advantage 4 solved their network management data storage problems with the Versant ODBMS. Among these, the Versant ODBMS is has been selected by five of the top six Telefone companies and by four of the top eight switch manufacturers. Versant not only enables telecommunications companies to develop the applications they need for increased revenues, it allows them to achieve their goals in the shortest time possible.

The next section provides an overview of the Versant ODBMS. The sections after that provide a more detailed look at how Versant applies to each of the seven aforementioned telecommunications applications.

THE VERSANT OBJECT DATABASE

Telecommunications application developers historically have turned to one of two methods to store information: flat files or relational database management systems. While (with no small amount of effort) flat files can store arbitrarily complex data, they lack the concurrency, distribution and integrity of traditional database management systems. Although relational systems do offer these traditional DBMS benefits, their table-oriented data model is unable to adequately model complex data and relationships, does not offer high performance in today's demanding environments, and is unable to store programmatic objects in their native form. In fact, second generation CODASYL DBMS technology, which required all data to be modeled strictly as networks, is easier to use for modeling complex, graph-structured data than the relational DBMS technology that replaced it.

Object database management systems like Versant offer a third path that is the best of both worlds. ODBMSs provide the flexibility to model and store arbitrarily complex, graph-structured data along with the power of true database management systems. In fact, because of the difficulty of modeling networks in non-object-oriented systems, many telecommunications standards are themselves defined in object-oriented terms. For instance, ISO standards for network management including the Guidelines for the Definition of Managed Objects (GDMO) and the Common Management Information Protocol (CMIP) are defined in object-oriented terms. What's more, many Bellcore technical reference standards ("TR" publications such as the TR-303 technical reference for remote digital loop carriers) are defined in object-oriented terms. Versant enables these standards to be modeled directly, without the need to develop "mapping code" to map the object schema to a relational DBMS, and without penalizing runtime performance by requiring costly relational joins.

Unlike other object database systems, Versant offers important features such as object-level locking, transparent data distribution across a network, online addition of data volumes, online dynamic schema evolution, and online compaction and relocation of objects. These features mean that Versant, with its proven "24 x 7" architecture, can deliver outstanding performance in concurrent, highly distributed, zero downtime telecommunications environments for a wide range of applications that require complex data types and complex relationships.

Performance for High-Availability Environments

Versant is extremely well suited to telecommunications applications because of the inherent performance advantages and high-availability capabilities not found in other object databases. Attainment of optimal and sustained levels of performance is naturally dependent upon application design and implementation variables. Recognizing this, Versant offers the most comprehensive suite of training, education, consulting and support services in the industry. Because telecommunications applications are highly concurrent and "bursty" in nature, minimizing concurrency conflicts is critical to their success. Versant's concurrency control mechanism uses locking at the individual object level, which maximizes sharing and can deliver the best possible throughput. Other object databases lock data at the page or container level, thereby limiting overall concurrency, since in such systems a given page or container can only be updated by a single user at any given time. This reduction in concurrency is simply unacceptable in the demanding telecommunications environment. Versant's transparent data distribution model makes it easier to build distributed applications because it eliminates the need to track the physical location of database objects in the network. Versant achieves transparent data distribution by providing logical object identifiers (LOIDs), which are networkwide, unique, immutable object identifiers that are automatically assigned to every object.

Versant objects on one node can transparently reference objects on other nodes, and objects can migrate from one node to another transparently without breaking existing application code or requiring changes to class or pointer definitions. In addition, Versant's industry-standard two-phase commit protocol ensures data integrity for distributed transactions. Versant maintains maximum performance over time by dynamically redistributing objects. Versant's LOIDs enable it to maintain physical storage clustering and locality of reference, and provide load balancing by moving objects

efficiently as needed. These features minimize disk I/O, allowing for the best possible performance. The performance of other databases, which lack Versant's sophisticated storage management capabilities, can degrade over time.These databases must be taken offline regularly to redistribute and re-cluster objects to restore acceptable performance levels – a process that is simply unacceptable in the demanding world of telecommunications.

In any switching system, configurations change, networks evolve, and OSSs change, making the ability of the database schema to change gracefully and without disrupting service an important consideration. Versant's advanced "lazy update" schema evolution overcomes the limitations of earlier technologies by automatically maintaining multiple versions of the schema object for a given class. When the class schema must be evolved, each class instance is then migrated from the old to the new schema ondemand (i.e., only when referenced). These lazy updates are performed online – a critical factor in a high availability telecommunications environment. This approach amortizes the cost of migrating all the instances of a class over a long period of time. Versant's logical OID-based architecture supports exceptionally large databases. While some relational databases have architectural limits of eight to ten million rows per table, Versant can support up to 2 * 1048 objects (2.81 tera-objects) per database, and over 65,000 databases per network. Versant provides a backup utility that supports both full and incremental backups. Versant also offers a replication capability to support hot-standby operations. These capabilities – combined with features like dynamic schema evolution, space reclustering, and space reuse – allow Versant to support mission-critical 24 x 7 telecommunications applications like no other database on the market.

Versant for Integrated Digital Loop Carrier (IDLC) Systems

The market for next-generation digital loop carriers is exploding as the competitive environment intensifies, especially in the United States. Deregulation and the emergence of digital services such as interactive entertainment, Internet connectivity and personal communications services (PCS) are creating unprecedented opportunities not only for local telephone companies and interexchange carriers, but for large cable television companies as well. A key ingredient in developing the infrastructure is the digital loop carrier, the most efficient method of extending the reach of the central office switch. These remote digital terminals make possible low-cost subscriber access to an increasing number of digitally based services.

Remote digital terminals (RDTs) operate in highly concurrent environments. Supervisory systems and multiple OSSs access a large number of objects at the same time. Versant's object-level locking provides optimal performance in this highly concurrent environment by eliminating the needless concurrency conflicts inherent in other architectures. Versant's transparent data distribution allows multiple supervisory systems to exchange objects between groups of remote digital terminals transparently across the network as they need updated information. And Versant's 24 x 7 capabilities, including online addition of data volumes and online data volume compaction for reduced overhead, are built into itsarchitecture to provide sustained performance over time. Versant is playing a key role in helping deliver the next-generation digital loop carriers. Versant is being used within these network elements to supportthe TR-303 information model by implementing the management information base (MIB), and to provide a supervisory system for managing both the RDT and the external OSS interface. The TR-303 information model describes the remote digital terminal's management functions in terms of classes, objects, attributes and methods, making this a natural fit for Versant.

Using Versant, the TR-303 information model can be placed directly into the database without having to write any of the complex interface code that would be necessary with a different information storage technology.

Versant is utilized in three primary areas within the RDT network: the supervisory system, the RDT itself, and as an adjunct to the central office switch:

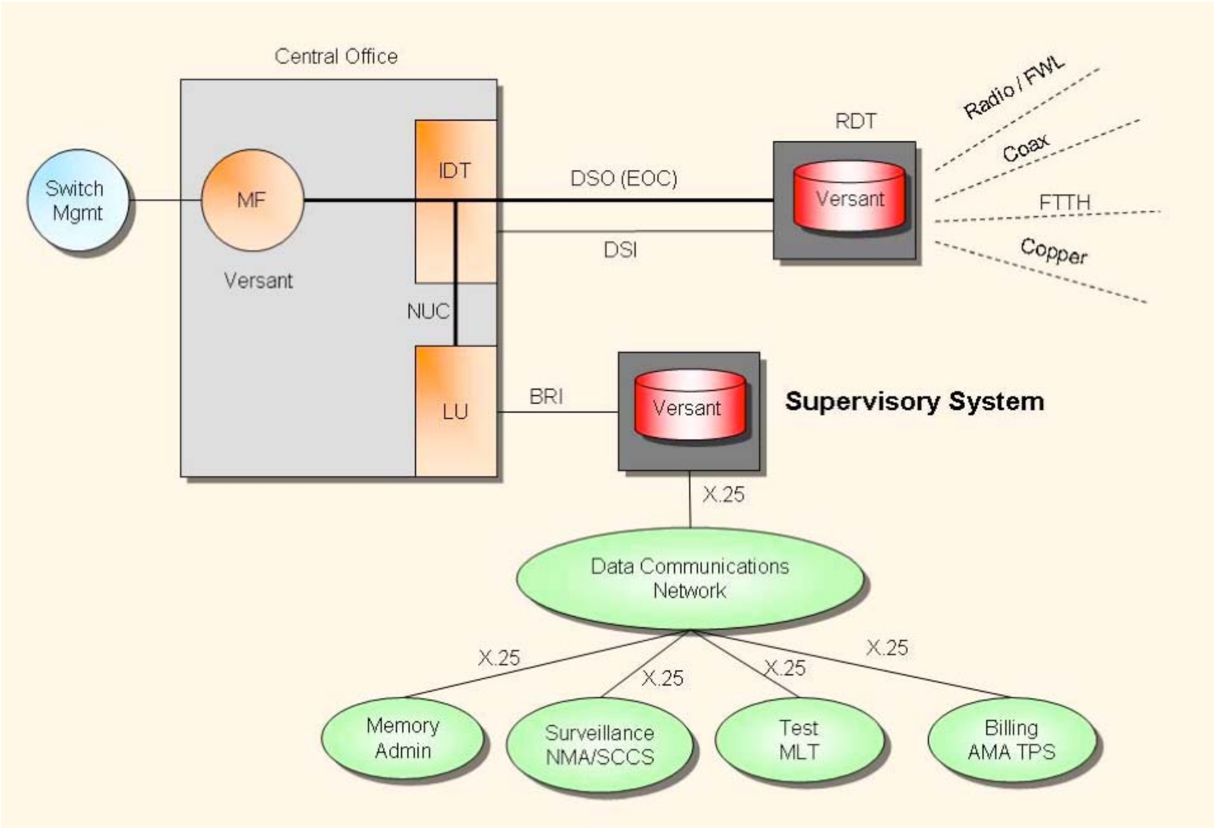

Figure 1: Remote Digital Terminal (RDT) network with the Versant Object Database

As an adjunct to a central office switch, Versant is being used to perform mediation functions between legacy OSSs and remote digital terminals. Switch management commands and requests arriving at the supervisory system from external OSSs for the remote digital terminal are parsed based on the MIB stored in Versant, which translates them into CMIP protocol using the appropriate CMISE service, e.g., M-CREATE, M-ACTION, etc. The CMIP message is then passed on to the terminal where the RDT acts upon the information contained within the CMIP primitive.

ATM, SDH, and SONET Element Management

As service providers attempt to cope with dramatic increases in network traffic, wider bandwidth transmission required by complex, distributed applications, and the connectivity needs of global multinationals, the entire public transmission infrastructure is being overhauled. This upgrade is made possible by the deployment of fiber-based SONET facilities nationally, and SDH internationally. With underlying SONET facilities in place, it is then possible for service providers to fully exploit this increased capacity with more sophisticated switching technologies like asynchronous transfer mode (ATM) and frame relay services.

Add to this the recent explosion of distributed applications dependent upon both Internet and Intranet backbones, desktop videoconferencing, and other multimedia applications, and the need for high-speed data transport over wide areas becomes critical. Asynchronous transfer mode uniquely satisfies this need, and as a result the development of ATM networks and the market for ATM switches is growing rapidly. SONET/SDH facilities and ATM switching operate in highly concurrent Managing Emerging Telecommunications Technologies for Competitive Advantage 8 environments. There can be as many as 200,000 to 400,000 active objects, in use by 200 to 1,000 execution threads, within a switch at any one time. Only Versant can support the concurrency and scalability requirements of these environments. As a result, Versant is finding application in both inter- and intra-switch management (to manage a switch itself as well as a group of switches). Versant has also been used to provide an OSS mediation function to enable these new technology switches to be managed by legacy OSSs via TL-1, which is similar to the mediation function offered by Versant in the supervisory system for managing remote digital terminals.

Versant reduces overhead and provides the sustained performance and flexible switch configuration updates – configuring the class hierarchy of the MIB without having to take the database off-line required for 24 x 7 availability. Today, Versant is being employed in several leading equipment manufacturers' element and network level management systems. Most every implementation is being done in accordance with the ITU-T's Telecommunication Management Network (TMN) technical specifications. Typically, vendors will utilize Versant for the repository of the management information base (MIB), the complete collection of objects that model the switch and its behavior. MIB sizes typically range anywhere from tens of megabytes to gigabytes, depending upon the complexity of the switching configuration and the volume of online configuration required to support fault and performance management functions. In the case of one ATM vendor's implementation, Versant contains instantiations of all managed objects (MOs), as well as support objects used to manage the operation of the switch. These objects are used for management functions, performance monitoring and analysis, and the setup and teardown of virtual circuits and virtual paths. A transaction-intensive use of Versant in this element management scenario can be seen as the ODBMS is responsible for both manager and agent functionality. In this case, Versant maintains the configuration and current state information associated with the on-board switch-based processors that establish logical circuits based upon physical line availability. Abstracted one level, this detailed information provides input into the operations, administration and maintenance processes necessary to effectively manage the element in near realtime. When relied upon in this context, Versant can be used to track all routing tables so that when a provisioning command is delivered to the switch, the ODBMS can determine which route is most cost-effective (considering time/distance trade-offs) and which will support the desired level of service quality. Offering support for virtual permanent circuit (VPC) setup and teardown is a task well suited for a fault-tolerant, high performance ODBMS. Versant is also used to store all the information on how to manage the switch when presented with commands from external OSSs. Typically when the switch receives a network management request from a remote OSS, an OSI stack first converts the message from the format of the external OSS to a CMIP protocol message. This CMIP protocol message then goes into an object request broker (ORB) or object arbitrator, which determines the type of management function to perform and loads the appropriate top level objects for the OSI management so the message can be sent to and understood by the support or managed object actually doing the work of communicating to the switch.

For element management solutions to be truly effective, they should incorporate TMN industry standards into a scalable, highly distributed software architecture.

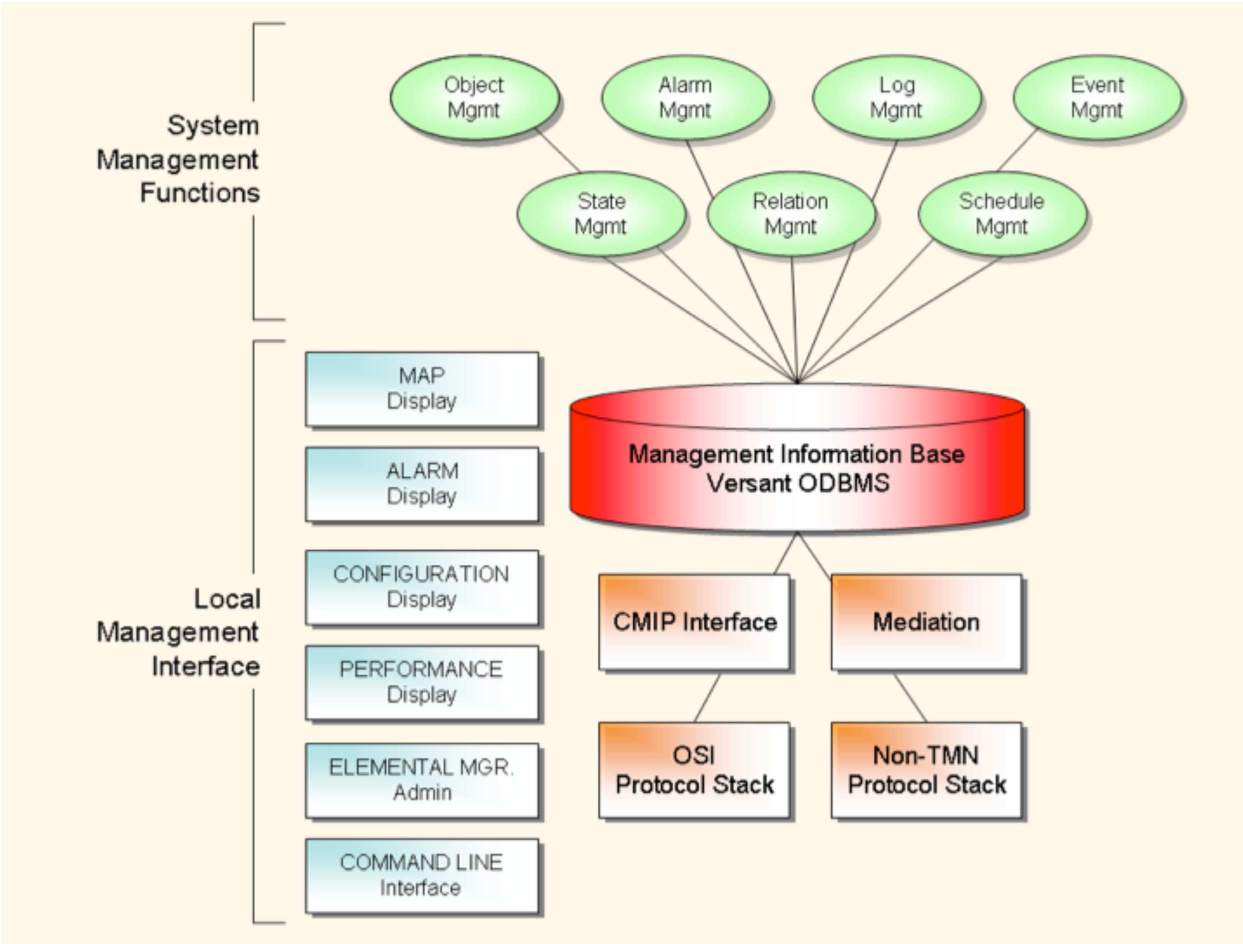

Figure 2: Truly effective: Element Management Solutions should incorporate TMN industry standards into a scalable, highly distributed software architecture.

Advanced Intelligent Networks

Telecommunications providers today are confronting a services dilemma. On one hand, they are being pressured by their customers to rapidly create and deploy a variety of new services, such as origin routing, personal numbers, or voiceactivated phone cards. On the other hand, the cost of implementing a full advanced intelligent network to support these services is prohibitive. The telephone companies are discovering that they don't have to pay a large sum of money for an AIN-enabled CO switch with the associated software and hardware, plus the substantial annual software usage fees. Instead, they can achieve very similar functionality using existing switches at a fraction of the cost by utilizing IP or service node technology that is a low-cost, UNIX-based processor solution. Versant is being used by customers to create intelligent peripheral or adjunct type products, where services can be implemented quickly and with minimal network infrastructure modification.

Versant excels as the repository of routing tables, service profiles and network based software because of the need for high-speed, complex associative lookup and access to data in a distributed environment. Some service logic databases are read-only and some are read-mostly/write-sometimes, while those with higher levels of interaction are read/write. In all cases, service logic databases demand a high level of concurrency because they may be handling hundreds of calls each second, and require quick remote access to the data without contention. Managing Emerging Telecommunications Technologies for Competitive Advantage 10 Versant's object-level granularity provides maximum performance in a highly concurrent distributed environment like this. Versant minimizes network traffic by balancing compute resources between client and server, processing queries at the server where they are closest to the data and returning only the qualified objects to the client. Versant also provides efficient dual caching to reduce network traffic by taking advantage of client storage capacity to hold objects until the pertinent transaction commits. And Versant's 24 x 7 capabilities, including online addition of data volumes and online data volume compaction, keep service logic databases up and running 24 hours a day, seven days a week, by allowing maintenance to be performed without taking the database down. Several national and international service providers depend upon Versant ODBMS for key IN functions like dynamic call routing used in virtual private networking (VPN), distribution of caller profile information used in home location register (HLR) type applications, and billing modules which can accurately price in-call transitions as callers navigate multiple sources of information. Imagine hundreds of thousands of citizens using their pre-paid calling cards to access the national carriers' free phone service. As the card is swiped in the pay phone, a transaction accesses the central office repository that either locally or remotelyresolves the "can this call be allowed to proceed?" question based upon card value and called destination.

The ODBMS must be available 24 hours a day and seven days a week and offer the kind of real-time performance which users of the public voice network have come to expect. In early prototyping of such high-volume services, it was determined that traditional relational database technology would be unable to support the demanding call-per-second and other requirements characteristic of IN applications.

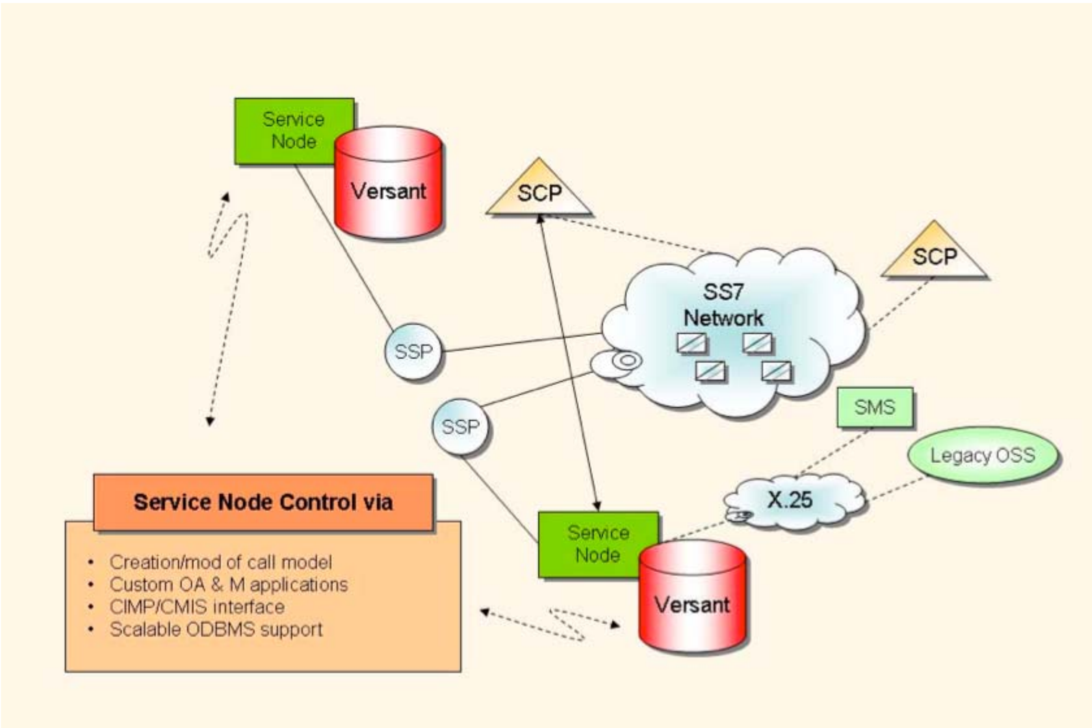

Figure 3: Versant provides for the efficient, transparent, and high performance distribution of AIN service logic across CCSS7 networks.

Using Versant ODBMS for traditional dealer locator IN applications, the signaling point functionality is contained within a service node implementation. In this case, service features are added by intercepting and controlling the signaling for a call and accessing the Versant database as required for service information. The speech path of a call requiring database facilities is "parked" on the outgoing side of a loop route while the signaling is directed to the database via the CCSS7 network. When the call control messages are returned to the access exchange after manipulation by the database, the parked call is taken from the incoming side of the loop route and switched to its final destination. The loop routes can be distributed around the switching network to avoid concentrating traffic on a particular central office switch, and any digital exchange connected to the CCSS7 network can become an access exchange by the creation of a loop route.

Head Office Collectors and Billing Systems

As telephone companies add new services - wireless services, ATM services, personal numbers, voice messaging, and calling cards and build their advanced intelligent networks, the mundane tasks of accounting and billing present new and complex challenges. Customers are demanding new billing services such as fraud protection, credit limit analysis, daily billing information, message detail recording, and consolidated billing. In addition, new requirements such as TR-1343 automatic message accounting (AMA) call for very complex data structures and real-time, online billing modification. These, in turn, are creating the need for a new technology for real-time data acquisition and billing systems. Versant is helping AMA become a reality by enabling the implementation of real-time data filtering, scoping, and discrimination in support of AMA data server and data processing and management system functionality. The AMA (TR-1343) data model is specified in object-oriented terms, making its implementation a perfect fit for an object database. Versant is the only object database capable of providing the performance and reliability required by the high concurrency, high availability demands of AMA.

Versant's object-level granularity delivers maximum performance in highly concurrent, distributed environments, and its broad platform support allows service providers to tune their costs by enabling them to buy just the amount of processing power they need for a particular application. Its online storage management features (volume addition, data compaction, object relocation, etc.) keep uptime to a maximum for true 24 x 7 availability. Core data server and data processing and management functions of the AMA system are being built on Versant today. Versant makes it easy to implement all the standardized accounting, configuration, fault, performance, security and other supporting objects that perform the data server and Data Processing Management System (DPMS) functions. First, as AMA records or billing data generated by mobile telephone switches, PSTN switches, ATM switches, and other network Managing Emerging Telecommunications Technologies for Competitive Advantage 12 elements are received by the data server using appropriate protocols. The data server updates the appropriate accounting meter objects and passes completed meter data upstream to the DPMS in real-time based on applicable filters (e.g., some may be gathering fraud data). The DPMS, in turn, performs post-processing and analysis necessary for the various value-added services mentioned above. The processedinformation is then sent to the centralized billing system for printing or to individual customer network management systems for real-time billing histories.

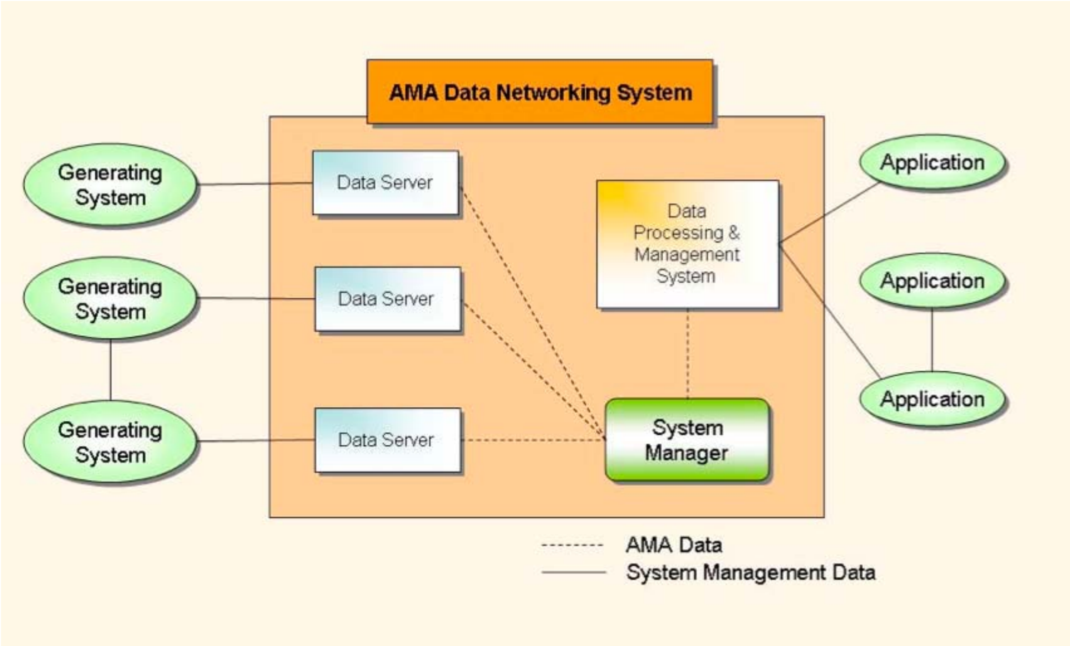

Figure 4: Automatic Message Accounting System (TR-1343) block diagram. Versant is enabling customers to support CDR consolidation, scoping and discrimination functions on real-time AMA data. (Source: Bellcore TR-1343 Documentation)

Operations Support Systems

Telephone companies today are burdened with a huge investment in legacy operations support systems systems that for years have provided the centralized alarm, configuration, performance, accounting, and security management functions for older technology network elements, but which are unable to directly manage the remote digital terminals (RDTs), mobile telephone switches, ATM switches, intelligent peripherals and other new technology network elements which are constantly being added. Service providers need a cost-effective way to leverage the investment represented by legacy OSSs, while they incrementally add more sophisticated network elements.

Versant, by fully supporting the object model, is enabling customers to comply with new telecommunications standards (ITU-T) and to develop TMN applications faster. Versant is being used to augment existing OSS architectures by the storage of multiple information models allowing applications to mediate between their older command structures and the new technology network elements. Versant accomplishes this by providing a way to store the information model from the existing OSSs using its native data model and converting it to a data model appropriate for managing these new technology network elements. For example, using Versant objects can be defined to model the command structures of legacy OSSs that communicate via a structured ASCII-based control language such as TL-1. As TL-1 messages arrive, they are stored in these objects based on the OSS's information model. Methods on these objects from the TL-1 command stream can create nethat can be sent to a network element like an RDT.

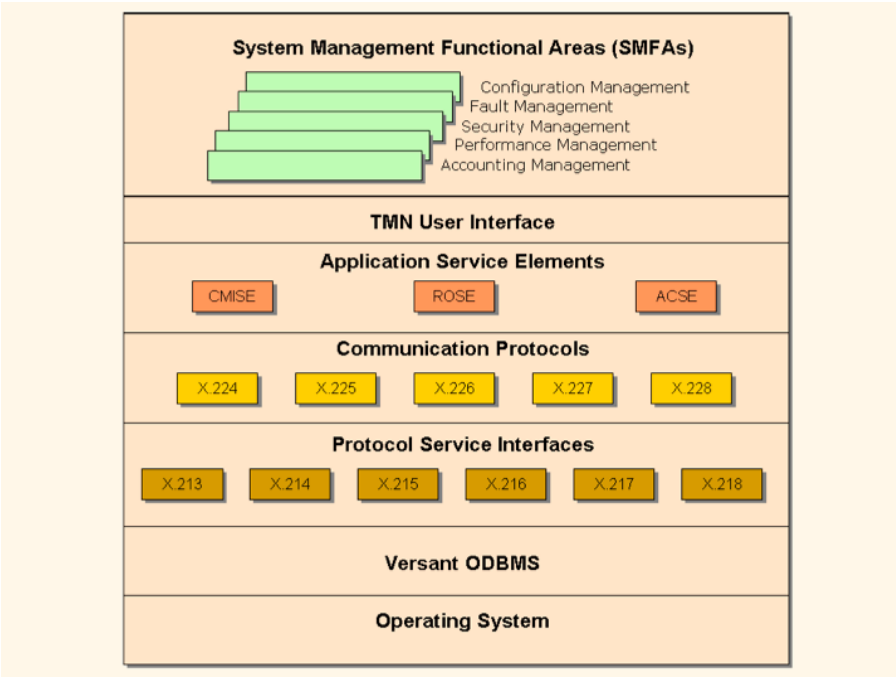

Figure 5: Software Architecture to support TMN applications.

In addition to its role in the mediation function, Versant is being used to implement the Manager side of the TMN Manager-Agent paradigm. For example, consider an interexchange carrier who has partnered with several other providers of global voice and data services. As service level agreements are negotiated between the customer on one side, and multiple service providers on the other, it becomes essential that the service providers have accurate and distributed access to logical quality of service statistics. This style of TMN network management, fully exploiting peer-to-peer application networking over a wide area packet switched network requires support for very complex data types. The challenge many Versant customers have solved is being able to model not only network attributes, but service and customer attributes as well. By abstracting the lower layer TMN data stores, and overlaying that data view with a more logical representation of the customer's end-to-end service profile, true Managing Emerging Telecommunications Technologies for Competitive Advantage 14 quality-of-service statistical analysis can ensue. The real payoff here is that when network anomalies occur, proactive management processes facilitate more of a 'partner' dialogue with the affected enterprise customers. This in turn leads to increased goodwill, heightened customer satisfaction, lower churn rates, and eventually, predictable profitability.

The Versant ODBMS plays an integral role here due to its unique ability to support Manager applications with state-based views of management information. Whenever the network state changes, pre-defined event templates will automatically evaluate an alarm condition and if the delta violates a userdefined threshold, will asynchronously notify an external fault management application. At this point, further root cause alarm analysis can determine if user intervention is necessary or desirable. Event notification facilities, integral to Versant, for the first time offer designers of TMN solutions the kind of seamless support between C++ or Java language development and the persistent object store necessary for proactive, next generation OSS's. Unlike other ODBMs, Versant offers an integral facility known as the Fault Tolerant Server (FTS). By leveraging the transparent FTS, operators concerned with disaster recovery scenarios can truly support redundant data volumes using distributed two-phase commit protocols over TCP/IP. That way, when one data center becomes isolated due to power, computer or application failures, the surviving center can provide distributed surveillance centers with an end-to-end view of the switching and transmission infrastructure. This leads to optimal levels of reliability, network integrity and overall system availability.

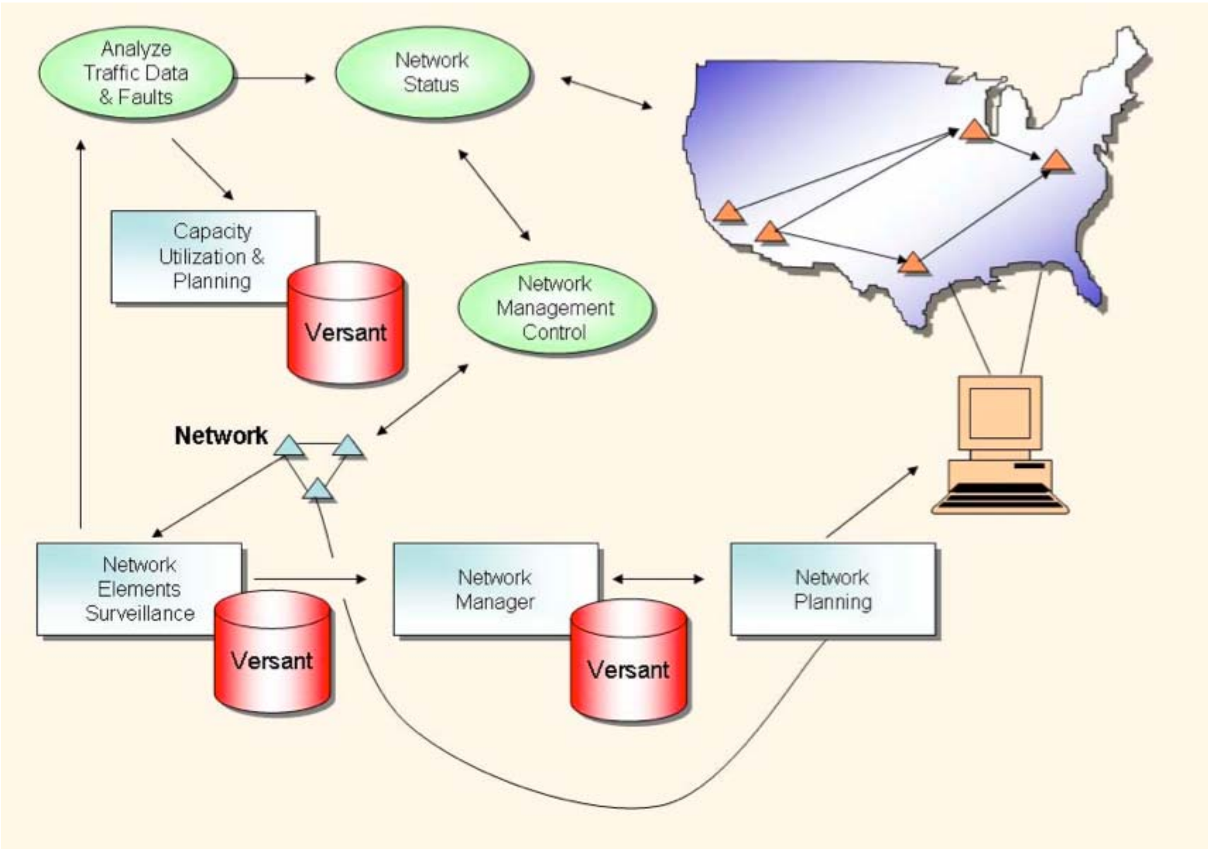

Figure 6: Due to the complex data relationships needed to effectively abstract a network level view from element-derived fault data, the ODBMS is uniquely qualified to support several OSS functions.

Inter-Service Provider Electronic Bonding

One of the most fascinating results of the rapidly changing competitive landscape and the increasingly deregulated operational environment is the need for interservice provider and intra-carrier information gateways. Such gateways facilitate the exchange of customer or service-specific information between a myriad of incompatible and highly distributed operational and business support systems. Fortunately, several standards organizations including ISO/T1M1 and the Network Management Forum (NMF) anticipated the requirement to electronically share fault management and trouble ticketing information across a dependable, standards-based facility. By leveraging existing standards where possible, the NMF grouped a proper subset of functionality into interoperable building blocks which developers could rely upon to reduce time-to-market. Given the complexity of the information models, the need for transparent distribution of related objects, the desire to be TMN-compliant, and the need for 24 x 7 availability, it was natural to incorporate an ODBMS into the internals of the messaging facility, commonly referred to as Electronic Bonding (EB). Already, several systems integrators have implemented production EB gateways that are being used to exchange trouble ticketing information among Regional Bell Operating Companies and Inter-exchange carriers nationally. As the EB facility becomes better understood, incremental applications are being developed for deployment across the gateway. Primary Interexchange Carrier/Customer Account Records Exchange (PIC/CARE) applications, which are needed to assign the proper long-distance carrier to corporate and residential customers, are perfect candidates for the EB gateway. Considering today's manual process of accepting the customer PIC request, keying change order data into proprietary systems, and printing and faxing work orders to all downstream service providers, it is understandable that there may be weeks of delay and the potential for errors due to re-keying of information among incompatible legacy systems. The value of EBrecognition for the new carrier and increased customer satisfaction.

Additional EB applications could extend to inter-carrier settlements, exchange of Internet Service Provider configuration information and even sharing of customer information between the service providers' proprietary systems. When implementing EB solutions, it's important to achieve the levels of reliability and availability that carriers have come to expect of online, mission-critical systems. Given the distribution of complex data and the requirement for TMN compliance, a production quality ODBMS is essential.

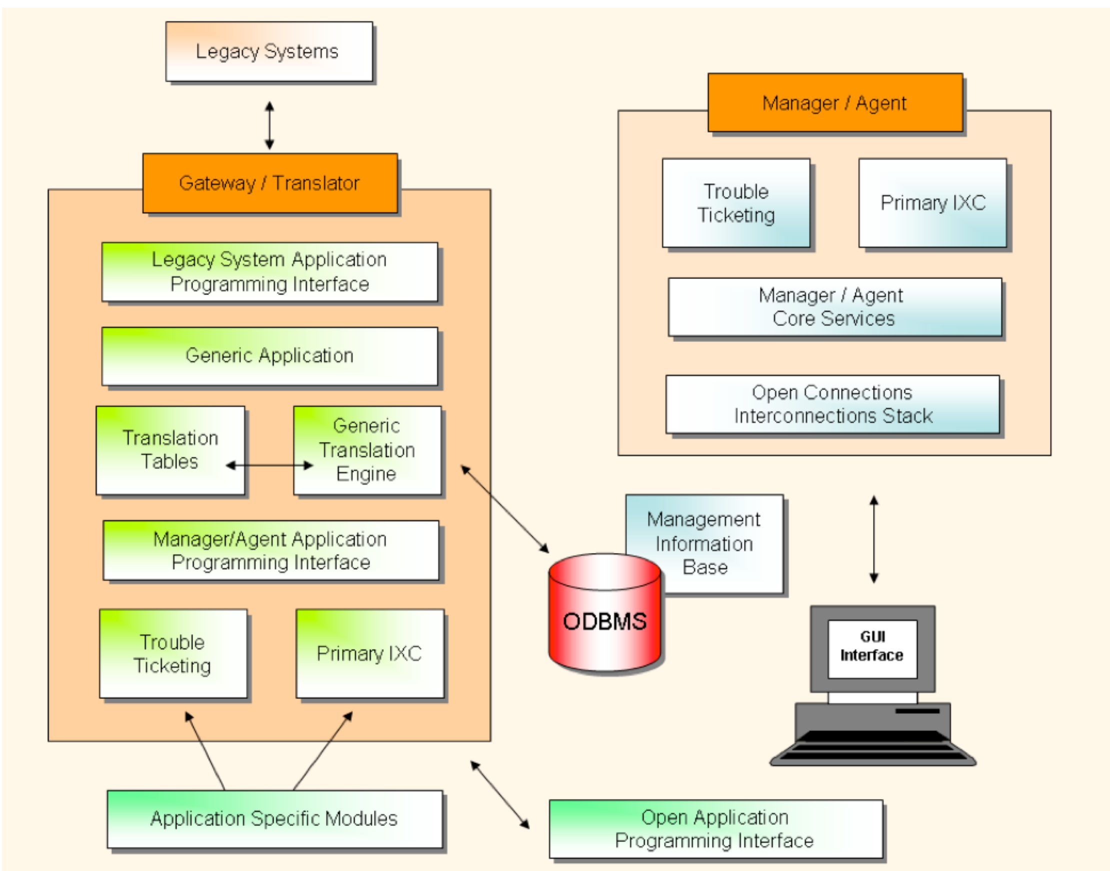

Figure 7: In order to provide high performance and continuous availability for emerging Electronic Bonding gateways based upon the ANSI T1.227/228, the Versant ODBMS provides a persistent repository for application and network configuration data. By distributing key customer profile information to the appropriate gateways, the time required to resolve customer complaints or switch to another preferred interexchange carrier is significantly reduced.

VERSANT – THE RIGHT CHOICE FOR TELECOMMUNICATIONS

Versant is the most widely deployed ODBMS in telecommunications today. Whether managing RDTs or ATM switches, enabling service logic databases, supporting head office collectors, driving OSSs, or providing customer network management, Versant is able to deliver the performance, reliability, and flexible data modeling required by the next generation of telecommunications applications. From its inception, Versant has been architected for and deployed in high availability, 24 x 7 environments, and is in use today by companies around the world developing and delivering advanced telecommunications equipment and services. Versant is committed to developing and maintaining applications with its partners and to their long-term success in meeting the challenges of the future.

ABOUT VERSANT

Versant Corporation (NASDAQ: VSNT) is an industry leader in specialized data. Using Versant's solutions, customers cut hardware costs, speed and simplify development, significantly reduce administration costs and deliver products with a strong competitive edge. Versant's solutions are deployed in a wide array of industries including telecommunications, financial services, transportation, manufacturing, and defense. With over 1 million installations, Versant has been a highly reliable partner for over 15 years for Global 2000 companies such as British Airways, US Government, Financial Times, IBM, and MCI.

NON-SQUARE DATA MANAGEMENT.

Get rid of rigid row and column structures when it comes to storing and retrieving complex data. Release the full power of a consistently object-oriented software application design. Non-square data management with Versant's object database technology – rapid development, high performance and massive scalability.

Versant's Object Database Management Systems (ODBMS, OODBMS) are used in a wide variety of industries to store and access hierarchical, and graph-oriented data in Java, C++ and .NET applications. It helps companies to handle complex information in environments that have high performance and high availability requirements. Using the Versant Object Database – instead of traditional relational database systems – customers cut hardware costs, speed and simplify development, significantly reduce administration costs, and deliver products with a strong competitive edge.

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