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A Brief History of TMN

A straight plunge into the minutiae of TMN can have a chilling effect on the unprepared reader. Perhaps the best warmup exercise is to gain some appreciation for its motivation and history. A basic understanding of the goals and reasoning behind the final (or rather, current) product will help in viewing the TMN's countless details in a coherent, logical perspective. This section, however, does not seek to provide an accurate historical chronology. Rather, it reverse-engineers what might have been the history of TMN and what might have been the rationale behind some of the major decisions in its development.

The fictional history starts with one of the most significant events in modern telecommunications. Tellingly, the event in question was a local, legalistic event rather than a global, technological breakthrough: the breakup of the Bell System in the United States on January 1, 1984. Suddenly, Local Exchange Carriers (LECs) responsible for some 100 million telephone lines were allowed and encouraged to procure their equipment from a large array of competing suppliers. Those LECs, which were used largely to obtain their equipment from a single source (AT&T's Western Electric, forebear of Lucent Technologies), enthusiastically embraced the new opportunity. While switching and transmission components from different vendors could interoperate through use of the same signaling and transmission protocols, they sadly did not have the same interfaces to Operation Systems (OSs). The new LECs had to acquire different OSs to manage Network Elements (NEs) from different suppliers. The increased cost of duplicate systems was compounded by decreasing flexibility: OSs from different suppliers could not exchange information or communicate with the same set of higher level OSs and Work Stations (WSs). It soon became clear that the cloud of noninteroperability was looming large over the silver lining of multivendor procurement. TMN was conceived to diffuse this cloud.

A band of TMN visionaries soon gathered under the auspices of the newly formed Alliance for Telecommunications Industry Solutions (ATIS) in an effort to turn dream into reality. Their objective was plug and play: allowing an OS from any supplier to plug into NEs, OSs, and WSs from any other supplier in perfect harmony. This said, the only remaining task was to define the salutary plug. The search was guided by the following criteria:

1. Interoperability
2. Full network management functionality

3. Complete freedom of local implementation
4. Broad industry acceptance

Each of these criteria has had such a profound impact that it deserves some clarification.

Interoperability means that two communicating systems need not use the same hardware platform (for example, they can use different processors), the same operating system (for example, one system can be based on Unix while the other uses Windows NT), or the same conventions for representing data (for example, one system can use ASCII while the other uses EBCDIC). Furthermore, one system does not even need to know what hardware, operating system, or data representation is used by the other. A considerably more challenging requirement is that an OS that manages a NE need not know how that NE is built. (That information may be a trade secret that the NE supplier will not share with the OS supplier.)

Network management functionality mandates that any interaction required for the purpose of efficient network management be supported over TMN-defined interfaces. This became the opportunity for network managers and operations planners to dust off and augment their wish lists of functions for effective network management. Here are two examples of wanted functionality, one dealing with switch configuration management, and the other, closer to security, dealing with access control management:

- Send a message to a Central Office (CO) requesting that all the line cards that were installed after January 15, 1995 and in which feature A is active should have feature B inactive and report the change, if any, to the accounting system.
- Specify that any SONET technician from the North District can reconfigure any SONET NE in that District, can test any SONET NE in the North and Central Districts, and can check the status of any SONET NE.

Local implementation freedom precludes any constraints on how a system is built, as long as it interfaces with other TMN systems. This requirement allows suppliers to use their unique expertise and creativity to develop better products, rather than mandating a commodity market for NEs and OSs.

Industry acceptance is the all-important reality check: the TMN specifications must gain broad acceptance from competing suppliers and competing service providers in order to ensure the availability and deployment of TMN-based products.

Such criteria may have seemed foolhardy in 1984. They still do today, even though numerous TMN-based applications are now up and running.

The first order of the day for the TMN founders was to look for any ready solution that might be out there. Three candidates were rounded up:

1. **TL1** (Transaction Language 1) from Bellcore. Several suppliers had implemented TL1. However, as a Bellcore specification, rather than an open standard created by a public body, its broad industry acceptance was in doubt. Furthermore, it was not clear that TL1 could conveniently support the wish lists for network management functionality that had been accumulating.
2. **SNMP** (Simple Network Management Protocol) from the Internet Engineering Task Force (IETF). Actually, SNMP was developed later, but this fictional history does not worry about such details. SNMP was originally designed to manage fairly small networks (by large LECs' standards) of fairly simple elements (for example, modems) with rudimentary processing capabilities (for example, 8-bit processors). It was not deemed capable of providing the functionality needed to manage large networks of complex elements (for example, COs).

3. **OSI** (Open System Interconnection) from the International Standards Organization (ISO). OSI was recognized as the emerging framework that satisfied all the criteria listed earlier and was therefore adopted as the foundation of TMN. At that time, however, ISO had no readily implementable standards specifying, for example, how an OS could remotely reconfigure a CO. And so along with its adoption came the realization that embracing OSI was going to be the first step of a long journey.

In order to ensure that TMN had a broad, international constituency and that its focus was on telecommunications, it was entrusted to the International Consultative Committee for Telephone and Telegraph (CCITT), which eventually became the International Telecommunications Union–Telecommunications standardization sector (ITU-T). In order to promote more intensive local efforts and customized specifications, regional standards organizations undertook to assist and complement the ITU-T efforts. These included most notably: Standards Committee T1, under ATIS and with accreditation by the American National Standards Institute (ANSI) in North America, and the European Telecommunications Standards Institute (ETSI) in Europe. The Tele Management Forum (TMF), formerly Network Management Forum (NMF), an industry consortium, soon integrated the emerging TMN standards, each addressing a small piece of the puzzle, into coherent network management solutions, with broad, international industry participation. In the United States, the Electronic Communications Implementation Committee (ECIC) was created, under ATIS, to provide complete and detailed implementation agreements for specific TMN applications between LECs and Interexchange Carriers (ICs).

An awesome library of TMN standards and implementation agreements has now been made available for supporting a broad spectrum of network management applications. Quite a few applications have already been implemented and deployed. Yet a lot more remains to be accomplished before TMN can be declared a success. The task is made all the more challenging by evolving business needs that require ongoing readjustment and fine-tuning of the TMN.

As early TMN applications were being deployed, it became clear that the impressive power and flexibility of OSI-based TMN carried an equally impressive price tag. Two lower-cost alternatives were therefore devised for applications with more modest requirements:

- Electronic Data Interchange (EDI) was inducted into the TMN to support applications that call for simple document exchanges (for example, placing a service order).
- Common Object Request Broker Architecture (CORBA) was added to the TMN, only for some applications at present, on the assumption that it would soon be freely available on every computing platform.

As we extrapolate our story into the future, all the preceding may become history. The reason is the explosion of data communications. In the early 1980s, data communications was riding on the voice network like a starling hitching a ride on the back of an elephant. Since then data communications, especially of the TCP/IP variety, has grown by leaps and bounds. Many industry gurus are predicting that by the year 20xy there will be only one network protocol and it will be IP. (As of this writing the value of xy is very much guru-dependent.) IP networks are being managed with the Simple Network Management Protocol (SNMP). As IP networks are poised to overtake all of telephony, calls are being heard to incorporate SNMP into TMN.

Although network planners crave the simplicity of one IP fits all, operation planners shudder at the prospects of having to deal with the rudimentary SNMP (it really is simple) for their growing charges. When IP networks were tiny (compared to telephony networks),

SNMP was ideal. As SNMP is applied to monumentally larger tasks, it may prove a bit too simple. Most likely, when SNMP becomes part and parcel of TMN, the ITU-T (as keeper of TMN) and the IETF (as keeper of IP and SNMP) will join forces to fortify SNMP for its higher calling. At this point, our futuristic history of TMN is overtly speculative. Nevertheless, since SNMP in TMN is a virtual reality, it is addressed in this book.

A glutton for protocols may claim that if one network management protocol is good, many are better. Eventually, however, the riches become downright embarrassing. Indeed, the proliferation of interface protocols detracts from interoperability. It is expected, however, that different protocols will be used for different applications, thus allowing for a better match between business needs and underlying technology.