5

What Do You Mean by a BVPN?

E. Colban, K. Hermansen and L. Kristiansen
Telenor Research and Development
P O Box 83, 2007 Kjeller, Norway,
Telephone: + 47 63 84 84 00. Fax: + 47 63 81 00 76,
e-mail: {Erik.Colban,Kjell.Hermansen,Lill.Kristiansen}
@ fou.no

Abstract

The notion of a Broadband Virtual Private Network (BVPN) is not precise. In this paper, we argue that there are few, if any, characteristic features that define BVPNs and that the meaning of BVPN is highly context dependent. One cannot abstract a definition of a BVPN without taking into account the environment in which it is to be deployed.

Keywords

Broadband virtual private network, VPN, TINA, service definition, service specification, telecommunication services.

1 INTRODUCTION

In this paper we study the notion of a Broadband Virtual Private Network (BVPN). Although it may seem clear what a Virtual Private Network (VPN) means with respect to today's networks, it is far from clear how such a notion should be understood in tomorrow's networks. We argue that many of the characteristic features of a VPN may loose their relevance as ,for instance, new access mechanisms are developed. A consequence of this is that BVPN may

F. A. Aagesen et al. (eds.), *Information Network and Data Communication*

mean anything from a leased line to a set of services. The term 'BVPN' must therefore be used with great care, always clarifying exactly what is meant.

In Section 2, we will look at a set of properties visible to the user and study their importance with respect to defining a BVPN. In Section 3, we look at possible characteristics from the customer's and network provider's perspectives. In Section 4, we study two BVPN cases in order to show that BVPNs can vary substantially if their environments are very different.

2 THE USER'S VIEW

In this section we will look into a set of features visible to the user which could be used to define the BVPN concept. For each of these features we will discuss the following:

- Is this feature necessary in a BVPN?
- Can this feature exist independently of a BVPN?

2.1 Broadband transport

In order to qualify as a Broadband VPN there must be some broadband transmission offered, so this is definitely a necessary feature. But it is a feature that the user only perceives when using a communication service (for data, video, etc.). It is these services, not a specific transmission bit rate, that allows us to call a network a 'broadband' network. Since these services may vary in kind and quality, it is not clear what a network needs in order to qualify as a broadband network. Broadband transport is necessary, but that it is unclear what this means to the user. Broadband transport can exist independently of a BVPN.

2.2 Multiple access points

Usually a BVPN has a certain "extent" or "range" defined by a certain set of access points from which the BVPN can be accessed. In most cases of today's VPNs, it is clear to the user whether she is placing a call from within the VPN or from the Public Network (PN) since she must dial a different number or hit an «escape» key. But the border between a BVPN and the PN can very easily be made transparent. Some mechanism in the BVPN and the PN may allow the user to request a call by specifying the user, and not the access point, that she wants to reach. If the user wants to call Jim, she dials 'Jim' whether she calls from the BVPN or the PN. Thus, the set of access points is not necessarily visible to the user.

It is easy to think of services involving multiple access points that have nothing to do with a BVPN. Universal Personal Telephone number (UPT) is one such example, Friends and Family another.

2.3 Closed user groups

It might be difficult to think of a BVPN that does not apply to specific set of users. A BVPN may typically be accessible to all employees of a firm and only them. However, we can think of examples where the identity of the user is irrelevant (e.g., in hotels). There are also examples of services that have nothing to do with a BVPN where it is relevant to define groups of users with different permissions. For instance, for a single line subscription, it may be relevant to have some form of password identification to discriminate between the parents and the teenage children.

2.4 Service access

A BVPN provides a context in which users may access certain services in certain ways. The set of available services and the way that these are accessed may be different in a BVPN and in the PN. For instance, the PN may only provide basic calls, whereas a BVPN may provide Multi-Media Conferencing (MMC). When placing a call, the called party may be specified by name in the BVPN, whereas in the PN, she is specified by an access number. A user may be barred from certain service uses in a BVPN that would be available to her in the PN (e.g., Outgoing Call Barring). Such differences are certainly visible to the users. However, they need not be visible if the set of accessible services in the BVPN and the PN are exactly the same and the user accesses them in the same way. A BVPN does not need to have any particular service or service access mechanism.

Differences in service access may exist although there is no BVPN. It is possible, for instance, to have a Private Numbering Plan (PNP) generally available in the PN. In general, every service that a user can access through a BVPN could be individually subscribed to (assuming that the PN supports those services).

2.5 Conclusion

From a user's point of view, a BVPN can be completely transparent, which means that there are no characteristic features visible to the user. What a user sees depends on the current set of features provided in the PN. Often, private and virtual private networks will have more advanced features because the investments necessary to introduce such features in the PN are so much higher. The differences change as the PNs aquire more and more BVPN qualities.

3 CUSTOMER'S AND NETWORK PROVIDER'S VIEW

The customer of a BVPN is to the user what the public network operator is to the user. This means that customer can be said to operate and manage a network that provides certain

capabilities to the user. For this reason the customer will have a different view of the BVPN than the user. Whereas the BVPN could be transparent to the user, the customer must have some model of the network she is operating on.

The level of detail of this model depends on the level of management that the customer wants to perform. If the management, for instance, is reduced to simply maintaining and updating a PNP, the customer's view of the BVPN the customer's view of the BVPN will be similar to the user's view. If the customer, on the other hand, is configuring network elements, monitoring performance, etc., the customer's model needs to be more detailed.

The network provider provides the customer with resources that allow the customer, in turn, to provide the user with the BVPN capabilities she needs. These resources may be low level, i.e. tied to network elements in the PN, or high level, for instance, service layer management services. Usually, the network provider will tend to hide the network complexity to the customer.

In the remaining part of this section, we will look at different features that may vary in the provision of a BVPN.

3.1 Reserved Network Resources

A BVPN may be configured using reserved resources in the PN. For instance, the customer may lease lines in the PN to interconnect several Customer Premises Networks (CPN). Alternatively, the route that the information from one CPN to another takes through the network may depend on the overall traffic in the PN. In this case, the users of the BVPN share resources with other users of the PN. Resources are not reserved, although the network provider may guarantee a certain level of availability of the connectivity resources or give the BVPN users a higher priority than other users, etc.

3.2 Services Provision

All or almost all services or service features available to the BVPN user could be provided by the network provider. Today, a CENTREX represents such a case. Alternatively, the services can be owned by the customer and run on the CPN as the case is for certain services that are implemented in the customers PABXs. There are many possible scenarios for sharing the development, ownership, maintenance, management and deployment of services between the network provider and the customer. For instance, a service may be developed by the network provider, sold to the customer, maintained by the network provider, managed by the customer, and deployed partly onto the CPN and partly onto the PN. Considering that there may be different scenarios for different components of a service, the complete set of all possibilities becomes very, very large.

3.3 Customer view of the public network

The customer may view the PN as a single node and not have the opportunity to monitor on separate resources in the PN. In this case the network provider's view differs considerably from the customer's. For instance, in order to obtain high availability, the PN may interconnect the CPNs using several connections. This is visible to the network provider, but not to the customer. Instead of viewing the network as a single network, the customer may have a more detailed view of the PN and may be able to manage different resources in the PN in order to optimize their usage. Therefore, the customer's view of the network varies in level of abstraction.

3.4 Subscription fees

One of the customer's motivations for subscribing to a BVPN is that it gives her a quantity discount. For instance, if there is high traffic between two geographically separate departments in a company, it may be cheaper for the company to lease lines between the two departments. If price is the only motivating factor, the customer could outsource the management and maintenance of the BVPN, so that all she sees is the bill. Alternatively, the customer could simply subscribe to a packaged set of services with a billing scheme that makes the use of the services within and between the customers premises cheaper than normal. These two solutions would appear equal to the customer. Whether the second solution is a case of BVPN is a matter of definition.

3.5 Monitoring and statistics

For purposes of optimizing the usage of a BVPN, the customer may wish to monitor the traffic or performance of the network resource. Another reason could be detection of fraudulent use of the BVPN. The customer herself could be responsible for collecting the data through management interfaces provided by the network provider. Alternatively, the customer could subscribe to periodical reports with relevant statistics or even let the network operator be responsible for optimization, etc.

3.6 Conclusion

The customer represents a step in the value chain between the network provider and the user. There is no clear demarcation between the functions, resources, and services provided by the network operator one the one side, and those provided by the customer. What is offered in the PN probably depends on the functions supported by the PN and on what can be dealt with more easily in the CPNs. It probably also depends on customers' demands and on prices. In

the long run, these conditions may change, and so will the respective BVPN views of the customer and network provider.

4 TINA BVPNS

Telecommunications Information Networking Architecture (TINA) is an architecture under development which, among other things, will enable rapid introduction of new services. One of the key features of TINA is the separation between physical infrastructure and high-level applications. Heterogeneity and distribution in the physical infrastructure is handled by a Distributed Processing Environment (DPE). The DPE provides a homogeneous environment to the application software developer, hiding differences in equipment technology and simplifying the task of integrating distributed components into management services or user services. We refer the reader to TINA-C (1994a,1994b,1995) for more details on TINA.

Today, many of the functions that TINA places in the application layer are tightly imbedded in the current physical equipment. This impedes the implementation of TINA in today's PNs. However, as the PNs are upgraded to introduce broadband capabilities an opportunity arises for introducing TINA as well. It is therefore relevant to study broadband services in a TINA context.

4.1 TINA BVPN in a PSTN environment

In this section we sketch a scenario for introducing a TINA type BVPN in today's Public Switched Telephone Networks (PSTN). Actually, «introducing» in not quite the correct word. The BVPN and the PN live side by side and are there is no integration, i.e. no «escape» mechanism. The BVPN can be regarded as a private network, except that the public network operator could provide certain resources, like a leased line between separate CPNs. The BVPN could be used, for instance, within a company for a set of «advanced» broadband services, such as MMC. Calls outside the BVPN are entirely handled by the PSTN. The BVPN is nothing but a small scale implementation of TINA.

In this case of a BVPN, there is a clear separation between the BVPN and the PN, also visible to the user. The user will be aware that the services available on the BVPN can only be accessed from certain locations.

Furthermore the access mechanisms used in the BVPN are very different from those in the PN. The access mechanisms in TINA support, among other things, user mobility. Network access points are not used to identify who to invite to a service session (e.g., who the «called party» is). This means that features such as PNP, Call Forwarding, etc., are not relevant in this case. On the other hand, configuration of the user profiles, etc., are highly relevant.

The customer gets very little for free. Since the BVPN is not integrated in the PN, there are no PN features that can be reused in combination with those of the BVPN. For instance, if user profile management were provided in the PN, this feature would not need to be added in the

BVPN. The customer also has to be responsible for almost all network and service management. This limits what can be outsourced to the public network operator.

The network provider and the public network operator may be different entities. The network provider could, for instance, be a software vendor who sells and installs an implementation of the DPE and all the required application software. The customer could go to the public network operator for the leased lines, and to equipment vendors for the switches and computing equipment in the CPNs. Since TINA is «open», the customer could develop and install additional services to run on his BVPN himself, or purchase it from a third party. This means that a BVPN need not be a single product, but a context consisting of many products.

4.2 TINA BVPN in a TINA environment

In this example we assume that the PN complies with TINA and that the BVPN is consistent with the PN it is introduced into.

We assume that the CPN consists of a set of resources (including the DPE), services and service components. These resources and service components are combined with some subset of those in the PN to form a BVPN. For instance, the CPN may contain a set of computing nodes and network elements, a DPE that spans all the network nodes which is capable of interworking with the DPE of the PN, a transport network interconnecting the network elements in the CPN, and several computational objects such a Connection Performer (CP) for establishing connections in the CPN transport network, a Name Server for naming entities belonging to the CPN, and Service Session Managers for services that are not available in the PN, etc. The network provider may provide a Connection Session Manager that will invoke the CP of the CPN whenever that is necessary, a set of generic service components for access, a set of management objects, etc. It would bring us too far to go into all the possibilities and details here. The point is that a TINA BVPN in a TINA environment will be made up from resources and service components from both the CPN and the PN and that there are many such combinations that could become a BVPN.

Contrary to the case described in the previous chapter (4.1), where the customer receives very little for free, the customer can reuse many of the components that have already been developed for the public network. Also, the BVPN may appear completely transparent to the user because she has nothing to contrast it with. The services she invokes are accessed in the same manner whether they belong to the BVPN or to the PN. Only if the BVPN provides services that are not available in the PN, will she be perceive a distinction.

VPN features such as Closed User Group and Personal Numbering Plan may become relevant in this context. Closed User Groups may be defined in the subscription profile for each service whether it is available in the BVPN or the PN and is therefore not a feature of the BVPN. Personal Numbering Plan should be given a slightly different interpretation to mean a

Naming context, i.e., a set of bindings of names to entities (1991). The entities may be the network access points in the CPN as well as any entities that are not referenced in the PN.

5 CONCLUSION

We have seen that there is no clear cut definition of a BVPN and that it would be very difficult to give one. The fact that properties of a BVPN will vary depending on the environment in which it is introduced, the set of functions that a network provider can offer, advances in CPN and PN technology, prices, etc., makes the concept ambiguous and unstable. At the end, we may even witness that any definition is so volatile that the concept itself is abandoned. This does not imply however, that cases like those sketched in Section 4 may be realized within the next few years.

6 REFERENCES

TINA-C (1994a) *Overall Concepts and Principles of TINA* Document No. TB_MDC.018_1.0_94*.

TINA-C (1994b) *Management architecture*, Document No.TB_GN.010_2.0_94.

TINA-C (1995) *Definition of service architecture*, Document No. TB_MDC.012_2.0_94.

RACE/PREPARE (1994) *D6.4A Virtual Private Networks*, Deliverable No. R2004/GMD/WP&/DS/P/016/b1.

ANSA (1991) *The ANSA naming model*, Architecture report AR.003.00.

7 BIOGRAPHY

Dr. E. Colban received his MSc from University of Oslo in 1986, and his PhD in mathematical logic in 1991. He has been working at Telenor R&D since 1991, mostly with service modelling methods. He was a TINA Core Team member from 1993-95.

Mr. K. Hermansen holds a MSc in physics from the University of Oslo. He has been involved in ISDN and broadband projects at Telenor R&D. Currently he is working with development of services in Intelligent Networks.

Dr. L. Kristiansen received her MSc from the University of Oslo in 1985, and her PhD in mathematical logic in 1993. Since then she has been an employee at Telenor R&D. She has been working with service creation in Intelligent Network, and formal methods and reuse in object oriented design.

---

* The TINA-C documents in this reference list are available on World Wide Web at http://www.tinac.com.