

SERVICE PROVISION IN COMMUNICATIONS NETWORKS

The present invention relates to the provision of services in communications networks. It finds particular
5 application in switched, intelligent networks, wherein intelligence is provided independently of the network switches.

In communications networks, including switched voice communications networks but also networks providing video,
10 data and the like, an area which is fast evolving is that of providing a choice of services to network users. It is desirable for the network operator to be able to introduce services quickly and flexibly. The network operator desires to be able to add services to its service portfolio without
15 undue delay or cost, and to be able to provide those services to customers as fast and as cheaply as can be achieved. It is often the case that network operators do not have the right to modify switches in their networks, the switches generally being supplied by independent switch vendors.
20 Consequently, the development of intelligent networks is attractive to network operators because, in the intelligent network, the determination and deployment of services can potentially be controlled without reference to the network switches.

25 Figure 1 shows schematically a basic intelligent network (IN) model. The transmission network 1 connects customer premises equipment (CPE) by means of switches 2 (only one switch being shown). However, above the transmission network level, there is the service control
30 level, incorporating Service Control Points (SCPs) 3, and above that again comes the service management level, incorporating a Service Management System (SMS) 8.

Each functional block of equipment, for instance an SCP 3 or an SMS 8 comprises computing platform 3b, 8b on
35 which sit applications 3c, 8c. The applications 3c, 8c, are pieces of software by means of which the computing platform 3b, 8b, is controlled to provide functions, via an Applications Programming Interface (API) 3d, 8d.

In practice, the service control level will be an information technology network in its own right and extremely complex.

Simple resources, such as voice, messaging, tone
5 generators and the like, can be picked up by the switch 2
from an intelligent peripheral 4. For instance, dialled
digits and Personal Identity Numbers (PINs) flow off the
transmission network 1, via the switch 2 to the intelligent
peripheral 4 for security checks by messages. If these
10 resources are supplied with the switch 2, then the network
operators increase their dependency on the switch vendors
which is generally undesirable to these network operators.

A development has been the provision of a service node
5, itself incorporating a switch 5a, the service node 5 being
15 connected at the end of a voice path 6 to the network switch
2. Service nodes 5 can provide complex resource interactions
and are being developed by network operators, increasing
thereby independence from the transmission network switch
vendor.

20 Looking at the SCP 3 and the service node 5, the
service applications 3c, 5c which dictate the services which
in practice are available to a network user can be provided
from either system. However, there remains the need for
services to be flexible and this has resulted in service
25 creation facilities 7 taking on considerable significance for
the network operators. Known service creation techniques are
based on the use of standard sets of building blocks which
can be brought together in different combinations to provide
new or different services. These are then made available via
30 the transmission network 1 usually by being automatically
compiled at the SCP 3, but being managed by means of the
Service Management System (SMS) 8.

This type of arrangement has considerably changed the
communications business in that service creation can be
35 carried out not only by the software engineer but, in effect,
by technically non-expert marketing personnel. This is
enabled by providing service creation facilities 7 working at

the graphical user interface level, for instance based on icons which can be pulled into flow chart representations of service "mechanisms".

5 The above describes the basic principles of service creation, wherein new services can be provided by pulling together standard building blocks from a portfolio of building blocks in relevant combinations.

According to a first aspect of the present invention, there is provided a communications network for providing one
10 or more services from a group of different services to each of a plurality of network users, wherein said network comprises transmission hardware for carrying telecommunications traffic, the hardware comprising communication channels along which traffic can be routed by
15 means of switches, and a service delivery infrastructure by means of which each service from the group of services is able to be made available via said transmission hardware to any network user having access to said transmission hardware, said infrastructure including control means for selectively
20 controlling the provision of services to such users in accordance with a library of user profiles.

In embodiments of the present invention, there is provided a service creation environment based on these basic principles but with which there is provided a service
25 delivery infrastructure in combination with a portfolio of service independent features.

According to a second aspect of the present invention, there is provided a communications network
for providing one or more services from a group of different
30 services to each of a plurality of network users, wherein said network comprises transmission hardware for carrying telecommunications traffic, the hardware comprising communication channels along which traffic can be routed by means of switches, and a service delivery infrastructure by
35 means of which each service from the group of services is able to be made available via said transmission hardware to any network user having access to said transmission hardware,

wherein said service delivery infrastructure comprises
data identifying the services of said group,
a stored array of service independent features, and means for
accessing the service independent features to support
5 provision of a selected service in response to a service
request incoming to the network.

Features in this context can be defined as reusable IN
components used in the construction of a service. For
instance, "Call Forward" is a feature in which a new
10 destination is always generated, but the nature of the new
destination, which could be a fax mail-box or another
telephone for instance, is not determined until that feature
is used in building a service.

According to a third aspect of the present invention,
15 there is provided a process for providing a service by means
of a communications network, which process comprises
receiving an initiating call from a user which purports to
initiate provision of said service, verifying availability of
relevant service independent features in the context of the
20 initiating call by reference to a user profile, and
responding to said initiating call in accordance with the
outcome of said verification.

Said verification and response can be carried out by
means of a blackboard technique, said user profile
25 incorporating service independent features which each will
register a view with the blackboard and, when triggered by
that view, will process the view, plus any additional
parameters, and post back resulting scenes on the blackboard
so that subsequent interactions between features and the
30 blackboard will be affected where appropriate by the
preceding interaction.

Features are "insulated" from the real physical world
in embodiments of the present invention by working with
logical representations. Features are assigned to profiles,
35 each profile being a data package associated with a network
operator, a customer or a user, and features are triggered in

a novel manner by use of a novel blackboard technique, being managed overall by the application of rules.

The principles of such a service creation environment can allow the network operator yet more control and flexibility, together with increased independence from equipment suppliers, just as so desired by the network operators. Surprisingly, although blackboard techniques are known in the field of artificial intelligence (AI) as being too slow to transfer to complex systems, it has been found possible in embodiments of the present invention to limit the complexity "visible" to the blackboard process in a manner which overcomes the question of speed, in spite of the potential complexity relevant to any commercially competitive communications network.

It has also been recognised in making the present invention that there can be a significant advantage in discerning between features and infrastructure in IN implementations. By separating features from infrastructure, communications networks, and particularly virtual communications networks, can be built to the customer's specification by only including features from a feature portfolio that are required rather than by inhibiting access to network functionality. In previous implementations, the features have been so closely related to the basic network service that feature selection has affected both access to network functionality and physical architecture.

A particular advantage of embodiments of the present invention is the independence of features, germane to service provision, from physical network attributes. This means that service provision becomes decoupled from transmission technology and therefore for instance transportable between synchronous digital hierarchy (SDH) - based and asynchronous transfer mode (ATM) - based networks.

A further aspect of embodiments of the present invention is that of dynamic replaceability, allowing new features to be added for any particular user, or to a particular network, without the need to interrupt service.

This is facilitated, according to embodiments of the present invention, by a mechanism relying on a Service Delivery Infrastructure which provides the insulation of features from the complexities of the physical world mentioned above by
5 working with logical representations of callers and stations, which representations for example take the form of Virtual Network Directory Numbers (VNDNs).

Embodiments of the present invention will now be described, by way of example only, with reference to the
10 accompanying Figures in which:

Figure 1 shows, as mentioned above, a basic model of an intelligent network according to known network architectures;

Figure 2 shows the conceptual separation of the
15 Service Delivery Infrastructure (SDI) and a feature portfolio;

Figure 3 shows a schematic representation of a user's service network as functionally available to the user;

Figure 4 shows how services may be provided across
20 different network systems and components, being presented to a user by means of service software (applications) running under a SDI sitting in the SCP of Figure 1;

Figure 5 shows a SDI in the context of physical entities of an IN, and its interfaces therewith; and

25 Figure 6 shows a pictorial representation of steps carried out by the SDI and related applications in response to an incoming call, to trigger relevant features.

It might be useful to note in the following description that "virtual communications network" is a known
30 term used to describe a network effectively dedicated to use of a single customer, such as an international corporate entity, which appears to the user much as a private network would have appeared in the past, defined in dedicated hardware, but which is defined from a much greater
35 transmission capability simply by software. That is, the virtual network is only limited, for instance in geographical layout and in capacity, by a software specification, in

accordance with the requirements of the customer, which specification allocates resources from an available pool of resources.

For instance, a network provider may have installed
5 international voice and data carrying highways, interconnected by switches so that voice and data can be routed appropriately, which carry multiplexed traffic for multiple customers, each customer however only being able to access traffic which originates and terminates at their own
10 Customer Premises Equipment (CPE).

In embodiments of the present invention, each customer can not only choose to change the physical capacity available to them by means of a virtual network but can also, independently, choose to change the service portfolio
15 available to them. For instance, a customer might already have available "time-of-day routing", in which incoming calls can be automatically rerouted after a particular time such as close of business away from individuals' offices to a number providing a recorded message. They might then decide they
20 also need authorization of outgoing calls to international destinations.

Referring to Figure 2, embodiments of the present invention provide a SDI 21 which draws on a portfolio of features 20 which are independent of the services into which
25 they can be incorporated. Looking at the service "time-of-day routing", the features involved might be a scheduling feature and a rerouting feature. But clearly, scheduling and rerouting are service independent, and can each be built into other services such as time dependent authorization and
30 "follow-me" respectively.

It is clear that the SDI 21 has to provide or interface with a wide range of network systems, such as Billing 22 and Numbering Schemes 23, these being provided overall by an intelligent network (IN). Referring to Figure
35 3, the customer however views many attributes of the IN simply as an extension of their own apparent service network 30. That is, the customer perceives services as being

delivered via a dedicated service network which makes use of the underlying physical network. Although the (perceived) service network 30 can define its own numbering scheme 23, it needs functionally to have interconnection with other
5 networks 31 and may be managed from a service creation environment 7.

Referring to Figure 4, it can be shown how services may be provided, by means of an SDI 21, across many different systems and components, being presented to the user through
10 "Service Applications", that is service software, running under the SDI 21 in the SCP 3. The physical transmission network 1, in this scenario, is managed by a Network Management system 40 which receives information from network elements such as the SCP 3 and can exert control over them.

15 In the following, object oriented software engineering terminology is used. In object oriented software systems, data and software are brought closely together in representations of real-world entities. The real-world entity may be an article or a process for instance, an
20 organisation or a booking procedure, but every real-world entity can be represented in the software system as an "object", that is a combination of data relating to the real-world entity but encapsulated in process-related software for accessing that data. The software implementing an object can
25 be described as data structures together with operations that express the behaviour of the object, and the object itself is any thing, real or abstract, about which one can store data plus operations to manipulate the data.

The Service Delivery Infrastructure 21 of the present
30 invention can be functionally defined in an object-oriented architecture.

Referring to Figure 5, which shows schematically a functional architecture of the SDI 21 of Figure 2, then one can see that services can be delivered to the customer
35 service networks 30 by bringing together features 20 from a feature portfolio.

Overall, the SDI 21 is structurally centred on the service networks 30 provided to the customers. When a customer user triggers a particular service, the SDI 21 will look to provide that service via the relevant service network
5 30. To do that, it clearly has to interact with all the usual, "real" systems associated with a communications network. In Figure 5, these real systems are represented outside the SDI 21, and the SDI 21 interfaces with those real systems by means of objects within the SDI 21.

10 In Figure 5, the real systems shown are a Network Management system 40, a Fraud detection system 51, a Billing system 22, a Service Switching Point 2 and a Service Distribution System 50. Taking the interaction with each of these real systems, clearly the Network Management system 40
15 is widely relevant to the SDI 21 since the physical transmission network must carry the services to the customers and its management is therefore germane. The network management interface will necessarily, therefore, interact with a great many of the objects in the SDI 21 and hence is
20 indicated to be application global by means of the Network Management object 52.

Fraud information will be collected by each of the service networks 30 and will be communicated to the fraud object 53 which encapsulates the interface to the Fraud
25 system 51.

Again, there is clearly a close link to billing for the individual service networks 30 and the SDI communicates with the real billing system 22 via an object 54 within the SDI, encapsulating the relevant interface.

30 A Service Switching Point 2 is a physical entity through which users and customer premises equipment (all distinct logical entities in themselves) will communicate with their service network 30. The Service Switching Point has a defined interface protocol which is virtually
35 encapsulated in a switch object 55 called, in Figure 5, the virtual Tandem switch object.

The Service Distribution System 50 is another real, separate system, which is responsible for mastering and distributing the managed objects on the SDI 21. The SDI 21 includes an object which contains all managed objects of the SDI 21, this being the Managed Information Base 56 (MIB). A CMIP-like interface is offered to the Service Distribution System 50 to manage the objects in the MIB 56. All managed objects of the SDI 21 support a common internal interface to the MIB 56.

10 It will be understood from object oriented environments that managed objects are objects in which data is encapsulated by management process software.

Because of, and in addition to, its interfaces to the outside real systems such as the Billing system 22, the SDI 15 21 provides the following:

- - A numbering scheme for an IN context.
- Switch and Call model virtual encapsulation and isolation of the physical network to service applications.
- 20 ● Distinct service networks as separately configurable and manageable entities.
- Access mechanisms to the network.
- A clearly defined interface of the service networks in to which will fit the Intelligent Network (IN) services.
- 25 ● An architecture supporting dynamic replaceability of component objects to allow for evolution.
- An architecture allowing schema evolution databases to permit new versions of features to be introduced without interruption of service or interference with previous
- 30 implementations.
- Interface to Service Management system allowing physical network, service networks, users and services to be managed.
- Interface to the network management system for network
- 35 monitoring and control.

Each of the above will now be discussed in more detail.

Looking first at the numbering scheme, in line with the real world representation of communications networks, every user of every customer on a service network 30 possesses a service network Directory Number (Service network DN).

5 This declaration of a numbering scheme has a number of significant advantages;

1. All call processing can be performed on a consistent representation of numbers.

2. The various physical addressing mechanisms of physical
10 network elements are isolated from the internal aspects of services of the service network.

3. It enables the support of multiple service networks 30 and provides an inherent mechanism for logical separation and discrimination.

15 4. It is in line with other communications network implementations.

5. It provides the customers with the freedom to build their own numbering plans.

6. It is a reusable component of the SDI 21 which would
20 facilitate its use in other applications.

All call processing is based on this service network DN. Considering the case of call screening, all accesses and terminations can be mapped to, and represented by, a service network DN, this allowing an effective screen to be built
25 using only service network DNs, and having no regard for representation of the physical access, thus comparing like with like.

An example numbering scheme for a service network may be a three part service network DN. The first part
30 identifies the customer network, that is, the service network Identity. Service network identities are unique within the SDI 21. The second part is the numbering plan cell within that service network 30. The numbering plan cell identity is unique within the service network 30. Number plans are
35 defined as required by the service network 30. The final part of the service network DN is the number. The number is unique within a number plan and can be of variable length.

The number can encapsulate other numbering plan standards, if desired, such as public numbers. This numbering scheme can easily support inter-number plan cell and inter-service network dialling.

- 5 Looking at access mechanisms, in the SDI 21 there are two types of access, dedicated and switched. Dedicated access is presented in the form of a switch/trunk and possibly Calling Line Identity (CLI). (Note this is British terminology for the US term Automatic Number Identification.)
- 10 Switched access is presented in a form of an Access Number. The SDI virtual Tandem switch 55 has knowledge of every possible physical presentation and which service network 30 that a particular access belongs to. Every access must correspond to a service network DN. Many access numbers map
- 15 to the same service network DN. Service network DNs do not necessarily have to be callable destinations. Additional restrictions, such as authorization for access, would be imposed by the service originating a call.

 Looking at SDI virtual Tandem switch object 55, the

20 SDI switch is responsible for the following:

1. Virtual encapsulation of the vendor specific call model and interface protocol.
 2. Maintaining knowledge of nodes.
 3. Obtaining, from service network directories, service
 - 25 network DNs from network addresses.
 4. Providing a standard operations interface into the SDI.
 5. Sending calls to a service network 30 or physical network for origination.
 - 30 6. Sending calls to a service network 30 or a physical network for termination.
 7. Making connections between legs.
 8. Providing^a management interface to the physical switch
 - 2.
- 35 A physical address describes an origination or termination in the language of the physical (real) SSP 2.

(Each physical address may have a country code associated with it.)

A node is a logical representation of an originating and terminating point in the physical transmission network 1.

5 A node has a Node Name which is unique within the service network 30. A node has associated with it a service network identity, originating attributes and terminating attributes. Originating attributes for a node are either an SSP/trunk pair, SSP/trunk/CLI triple or a public number for switched

10 access. The SDI-understood access number may be the CLI of the dialled number. Public numbers are inclusive of country codes. Numbers can be expressed in terms of ranges. Terminating attributes for a node are either an SSP/trunk pair for directly connected nodes or assigned break-out nodes or

15 null for public/other networks. (This assumes that a particular number routing analysis is performed by the physical switch, that is the SSP 2.)

An SSP/virtual trunk pair cannot be owned by more than one service network 30. The concept of nodes ensures that

20 knowledge of the physical network 1 is isolated and switch/trunk pairs only exist within the virtual Tandem switch object 55. A network operator can re-map nodes to different switch/trunk pairs without needing to change the SCP 3 view of the service network 30.

25 The virtual Tandem switch is provisioned with nodes. Since a node has originating and terminating attributes, the node can be determined based on whether the call is inbound or outbound.

A network address describes an origination and/or

30 termination point addressed by the virtual Tandem switch 55. Network addresses are associated with service network DNs. Network addresses comprise a node and number which can be private or public. The network address is the lowest form of address known within the service network 30. The virtual

35 Tandem switch 55 constructs the network address for an access. The identification of a node pin points a particular service network 30. Each service network has a service

network directory 57 which localises the association of network address and service network DN. The virtual Tandem switch 55 interrogates this directory 57 for origination and termination. The virtual Tandem switch 55 performs the
5 translation between network addresses and service network DNs.

In originating calls, for an access, a service network 30 is identified to handle the call. If a service network DN cannot be determined, the call is rejected and the caller
10 advised that the access is not recognised. Once a service network DN is determined, the virtual Tandem switch 55 originates the call on the service network 30. A unique dialogue identity exists for every dialogue between the virtual Tandem switch 55 and a service network 30. For
15 terminating calls, once all call possible processing has been performed within a service network 30, the virtual Tandem switch 55 is requested to connect the call. Depending on the nature of the request, the connection may be on the physical network 1 or on another service network 30 for further
20 processing.

The virtual Tandem switch 55 can be taken out of and restored to service under the control of the Service Controller object 58. The switch can be set to an overload state, triggering protective controls such as Call Gapping if
25 necessary. The service state of the switch 55 will be set through the common provisioning interface.

Provisioning of the virtual Tandem switch object 55 is done by managed objects of the Managed Information Base (MIB)
56.

30 The basic component of any connection is a leg. Every leg has an identity unique within the dialogue. Leg describes all that is known about a particular leg of a call and includes:

1. Node identity - may not always be present if contained
35 in the network address.
2. CLI - may not always be present.

3. Access number - the number dialled by switched access users to reach the service network 30.
4. Speech or data indicator - switch setting on whether the call is a speech or data call.
- 5 5. Routing indicator - setting on whether calls should be terrestrially routed.
6. Network address - the address of the leg in terms of the physical network 1.
7. Service network DN - the service network logical
10 address of the leg (includes customer service network identifier).

Regarding the virtual Tandem switch operations interface, a service network 30 can request the switch to create , delete and connect legs. Delete Leg may be
15 accompanied by an announcement. The switch can inform the service network 30 of certain predefined and prerequested conditions that may occur upon the execution of Create Leg or Connect request, for example "Is Busy". The switch 55 can be requested to ask for further input from a leg. Customer
20 service network can handover control of a call to the switch 55. A dialogue "End" can be sent to the switch 55 from the customer service network 30.

The switch offers the following operations interface to other objects:

- 25 Create Leg
- Delete Leg
- Connect
- Handover
- Ask
- 30 End
- Set Message

Communication with the switch object 55 is based on dialogue. Every dialogue is uniquely identifiable by a dialogue identity.

- 35 Regarding the service network 30, the service network interacts with the virtual Tandem switch 55 to communicate with other networks and to connect calls between itself and

the physical network 1. The service networks 30 are logically separate networks with their own numbering plans and numbers. A service network identity is the network identifier and is assigned by the network operator when the
5 network is created.

A customer service network 30 has the following major components:

1. Service network (central office) switch.
2. Service Directory
- 10 3. Atlas
4. Service Network Directory

Concerning the Service Network (Central Office) Switch 59, each service network 30 has a local exchange which is
15 capable of handling originating or terminating traffic and directing it to ^a service within its own network or to virtual Tandem switch 55 for connection on another network. The service network Switch 59 uses the service directory 57 to determine a service. It offers a similar operations
20 interface as that of the Tandem switch 55.

Each service network 30 has a service network number Directory 60 which describes network address and service network DN associations. The service network Directory 60 is interrogated by the virtual Tandem switch 55 both at
25 origination to Get service network DN and termination of a call to Get Network Address.

The Atlas 61 describes a notional association of network addresses or service network DNs, for example originating geographic area. The association is left to the
30 service network administrator to define.

The service network Service Directory 57 holds profiles which identify services. Every user on the service network 30 is identified by a service network DN. Every service network DN has a profile which identifies a service.
35 All these profiles for the relevant service network 30 are held in the Service Directory 57. The Service Directory 57 can be queried based on service network DN or on the

authorization code associated with an individual user. There is some information related to a user which is not service specific such as personal identification number (authorization code) and name. This type of information is held in a profile within the Service Directory 57. It can be referenced directly by the authorization code or through association with a particular service network DN profile. A service information profile fully describes the service as configured for a user. Profiles are derived from templates and created within the Service Creation Environment 7. Templates have no meaning at the SCP 3. The Service Directory accesses profiles based on service network DN and is able to identify the service that should handle the call. Profiles can have the attribute of time where a particular profile relates to a particular DN based on an expression of time. There is always one profile for a particular user for a particular time. A profile can provide different descriptions based upon time, ^{where} time can mean time of day, day of week or day of year (special day).

20 In hardware terms, the SDI 21 might be used on a Stratus hardware platform running FTX operating systems and interfacing with the SINAP SS7 communications package. The SDI 21 must support the dynamic addition and deletion of components and enable services to do the same.

25 The SDI 21 also provides a Fraud object 53 which virtually encapsulates the format and mechanisms of external fraud systems 51. Service definitions will detail the content and target of Fraud information generated by the service. The SDI Fraud object 53 will not understand the content of Fraud Messages generated by a service but will be capable of directing them based on type. Any controls, as a result of Fraud detected by external systems 51, should be exerted via the provisioning interfaces.

35 The SDI provides a billing object 54 which will be responsible for gathering, collating and packaging the required information on usage and forwarding it over the appropriate billing interface. Billing information is

generally service specific and as such the SDI billing objects 54 will not understand the content. They will however be capable of recognising a particular toll-ticket type and use that as a basis for discrimination.

5 There are two aspects to the service management of service networks. Firstly, the management and provisioning of new and existing networks (customer service networks 30), SDI objects and the MIB 56 describing the service network 30. Secondly, the evolution of service, feature and SDI objects to
10 newer revisions. Features and services are introduced to the SDI via the deposit of a feature or a service package in to a Library. Feature packages are deposited in the feature library using the FTAM protocol. A feature or service package contains all the necessary files required to
15 introduce the feature or service into the SDI 21. The SDI 21 maintains a managed information base 56 of all managed and provisionable objects and has a CMIP-like interface. The MIB 56 will have knowledge of every managed object, ^{whether it is} part of the SDI 21, service network 30 or a user. Provision will be done
20 from the Service Creation Environment 7 and forwarded to the SCP 3 via Service Management 8 and the SDS 50.

The network management object 52 will encapsulate the network management system interface. Alarms and events of the SDI 21 will be channelled through it as will the alarms
25 and notifiable events generated by services.

The SDI 21 structure, as described above, can support evolution without requiring interruption to service and an aspect of this is further described below.

Looking at the above description of the SDI 21, in
30 relation to Figure 5, one can see that an infrastructure is set up by means of which the features 20 which might be used in providing services on ² service network 30 are rendered independent of those services and of network functionality. When a customer user requires to access a relevant service
35 network 30, to be provided with a service, then the SDI 21 will respond, provided that there is no problem such as lack of authorization or the service being unavailable on the

relevant service network 30. The manner in which a service is actually triggered involves the blackboard technique mentioned above, wherein sufficient pieces of data must be present before a required feature for use in the service will
5 "fire". One of the factors in the firing of features is the content of various profiles, these being ^(as mentioned above) tailored sets of data, relevant to, for instance, the network operator, a customer, or a customer user.

A profile can be viewed as the specification of a set
10 of attributes describing how a particular service instance is to be tailored. Profiles can be global across all service networks 30, that is network operator defined profiles, network wide to a particular customer service network 30, or specific to a particular customer user. Where conflict
15 arises, the priority of profiles will be first the network operator, then the customer and finally the customer user.

A profile contains:

1. the service network DN
2. user attributes, these being default declarations of
20 call state that are established when a caller initiates a call and would include things such as default call type (speech, 3.1kHz, data),
3. authorization code,
4. rule list,
- 25 5. feature lists (originating and terminating).

Looking at the last of the above, every profile has lists of features that are available. Features are classified as originating features (for example outgoing calls barred, originating screening, network side updates,
30 restricted access etc) or terminating features (for example incoming calls barred, terminating screen, call forward, divert on busy etc). Every profile has two feature lists, one of originating and one of terminating features. A feature list contains, for every feature, the feature name,
35 feature view and feature instance reference. The feature instance reference points to the provisioned persistent

feature object instance for this profile. The feature list may in practice be empty.

Feature views are the representation of a call state that fulfils the conditions for that feature to be invoked.

5 The view that a feature requires is specified by the feature provider in the feature package. The view for a feature is specified in terms of the presence or absence of an element of the call context picture and expressed in boolean algebra syntax.

10 The interaction of features is governed by feature interaction rules defined for that profile. Every profile has a rule list. The rules governing use of the service network 30 and features offered by it are contained within the rule list. Rules control feature interaction and would

15 determine which features with coincident views would be allowed to obtain focus on the call. The elements of the rule list contain the rule and the view for that rule. The rule list may also be empty.

Rule views are the representation of a call state that

20 fulfils the conditions for a rule to be applied. The view that a rule requires is specified as part of the provisioning object that adds a rule to a profile. The view for a rule is specified similarly to feature views.

The network operator, providing the bearer network for

25 all the separate customer service networks 30, can use a network operator profile to govern how the service networks 30 behave. Any global rules or attributes that apply are defined here. Any features that control or specify specialised access mechanisms will be referenced in the

30 network operator profile.

A customer profile provides the customer with the ability to govern the behaviour of all users of his network 30. Rules, attributes and features that apply network wide are specified in the customer profile.

35 Every service network DN has an associated user profile describing what is available to that number on the service network 30. User profiles are contained within the

customer service network user list. A user profile is retrieved based on either the authorization code or the service network DN, and on the time of day. Thus a user gains his service network attribute set by either service
5 network DN and/or an authorization code.

To access the SDI 21, there may be two types of access, dedicated and switched. Dedicated access will be presented in the form of a switch/trunk and possibly CLI. Switched access is present in the form of an access number.
10 The switch object 55 is provisioned with knowledge of every possible presentation and which customer network that particular access belongs to. Every access must correspond to a service network DN. Many access numbers may map to the same service network DN. Service network DNs do not
15 necessarily have to be callable destinations.

In dedicated access, a user will dial a number and this arrives at the SCP 3 since it originates on-net. The "Nature Of Call" (NOC) values of the call indicates that an access is dedicated and the physical address is used to
20 determine a node identity. Nodes associate to a particular customer service network 30. The switch 55 constructs the network address from the node and CLI. The customer service network 30 is interrogated to obtain the service DN associated with that network address. The switch 55 then
25 passes the call to the identified customer service network for origination. Guards or restrictions to an access are applied from within the customer service network. Restricted accesses would be specified in the user profile that described a particular service network DN.

30 There are a number of types of switched access but all are common in the fact that they are delivered to the service network over public networks. all switched accesses use an access number to arrive at the service network 30. the access number is either dialled by the user or inserted by
35 the customer premises equipment. The physical address for switched access will not identify a customer service network since it will be a common trunk from another carrier. The

physical address will yield a country code. For switched access, the customer service network 30 is identified by either the CLI, a dialled access number or an authorization code. The SDI switch 55 is provisioned with a customer
5 service network association for all service dialled access numbers. Again, as for dedicated access, switched access can have restricted access placed upon it by virtue of the user profile stating that an authorization code is required.

BLA BOARD TECHNIQUE IN PROVIDING SERVICES.



A blackboard is a software object that maintains a picture of a call state. The picture changes as a call is progressed by the addition, subtraction and modification of scenes by other objects posting to the blackboard.

A call picture is the part of a blackboard which is visible to external objects. The call picture maintains the call state.

An external object may have a view on a call picture, that is a limited number of scenes of interest to the object. However, the object is not allowed to act until it has focused on its view. The focus is controlled and is used to sequence objects acting on the blackboard.

A scene is applied to the blackboard by means of posting. A scene is an individual element of a call picture that can be modified by external objects. Scenes combine to form a view.

The above is terminology of a blackboard technique which is used in providing a service by reference to a candidate list of features, using the SDI of the present invention. The technique is effectively a hybrid of associative and sequential processing, as used herein. It provides a practical real-time response by restricting the extent of pattern matching necessary to fire a feature, by incorporating in the relevant profiles a candidate list of features which is a subset of all possible features. There is, in practice, then a trade-off for the customer. The longer the candidate list of features to be available via their service network, the greater the risk of reduced performance from the network in providing services.

The blackboard technique functions as follows, for the originating leg of a call. The SDI 21 makes a translation to a service network DN and retrieves a user profile based on the originating DN. The user profile contains a list of originating and terminating features that may be invoked during the call. Features are allowed to focus on the call picture represented on the service network blackboard, under the control of the SDI 21 and the invocation of feature rules, until a quiescent state, resulting in a terminating DN, is reached. Translation from the logical world back to physical representations occurs when the feature requires further network interaction or the call is complete and requires a terminating leg.

If it is not possible to identify a user from the physical identifiers provided by the service network 30, the SDI 21 will prompt for an authorisation code. This will be used to allocate an originating DN so that a profile may be retrieved and feature processing may proceed.

A simplified representation of the retrieval of a profile from a service network DN, in this case an originating DN, is shown in Figure 6. The feature 65 registers a view with the blackboard 66. If there are sufficient elements of data present, that is there is a new phone number together with the state of 'no reply' for the feature 'Call forward on no reply', then the feature will be triggered by the view. Consequently, it will process the view plus any additional parameters and post back resulting scenes to the blackboard 66. Other features viewing the blackboard may then, when invited to focus on their view of the call picture, be triggered by the scenes posted as a result of another feature processing its view.



CLAIMS

1. A communications network
for providing one or more services from a group of
5 different services to each of a plurality of network users,
wherein said network comprises transmission hardware
for carrying telecommunications traffic, the hardware
comprising communication channels along which traffic can be
routed by means of switches, and
10 a service delivery infrastructure by means of which
each service from the group of services is able to be made
available via said transmission hardware to any network user
having access to said transmission hardware,
said infrastructure including control means for
15 selectively controlling the provision of services to such
users in accordance with a library of user profiles.
2. A communications network
for providing one or more services from a group of
20 different services to each of a plurality of network users,
wherein said network comprises transmission hardware
for carrying telecommunications traffic, the hardware
comprising communication channels along which traffic can be
routed by means of switches,
25 and a service delivery infrastructure by means of
which each service from the group of services is able to be
made available via said transmission hardware to any network
user having access to said transmission hardware,
wherein said service delivery infrastructure comprises
30 a stored array of data identifying the services of said
group, a stored array of service independent features, and
means for accessing the service independent features to
support provision of a selected service in response to a user
service request incoming to the network.