The Tmedia™ Call Routing Platform

PRODUCT BRIEF

OVERVIEW

Telecommunications service providers interested in optimizing their profitability in the face of intense revenue pressures must reduce or limit the amounts that they pay to transport and terminate calls. The routing table is a key element in such a strategy and the ability to keep the routing table current, while reflecting the complex web of carrier partner relationships, is paramount in achieving profitability objectives. TelcoBridges has developed a call routing solution, bundled with each and every Tmedia VOIP gateway, that simplifies the creation and maintenance of the routing table, enabling service providers to maximize the profitability of individual calls and the overall call volume.

BUSINESS OBJECTIVES

Telecommunications service providers such as calling card marketers, alternative long-distance providers, and smaller competitive local exchange carriers, face intense revenue pressures on a daily basis. To maximize the profitability of its business, the service provider must therefore reduce or limit the amounts that it pays to transport and terminate calls. This often requires routing a given call via one carrier partner in place of another according to a series of business criteria such as the calling destination, the time of day, and the absolute or even relative cost of a given provider, among many other potential criteria. The business rules that result from the application of such criteria and that determine how calls get routed are contained within a routing table. This is usually contained within the application software used to operate a service provider's telecom switching equipment. The creation and timely maintenance of the routing table is thus a key determinant in the profitability of a given call and the overall profitability of the service provider.

BUSINESS CHALLENGES

The business of costing out the transportation and termination of a call has evolved to the point that it can change multiple times a day for a given carrier partner; multiplying this by the number of carrier partners that a service provider interacts with means that there are potentially hundreds, if not thousands, of pricing inputs that can change on a given business day. The ability to achieve optimal profitability for a given call—and for the overall volume of calls—is therefore contingent on the ability to frequently aggregate, interpret, and integrate this constantly changing pricing information into the routing table. However, the reality of many smaller service providers does not always lend itself well to this scenario. Limited resources and the complexity of legacy equipment mean that access to anything approaching near real-time updates to the routing table is simply impossible or cost-prohibitive.

Call routing management is often a sub-set of the overall configuration and operations environment used to manage a telecom switch and thus typically requires a trained telecom engineer. Legacy switching equipment was conceived before the era of high frequency price changes and the multiplicity of alternative long distance and wholesale carriers, when an annual or semi-annual update to the routing table was considered to be the normal state of affairs. In those days, it was feasible to have the telecom engineer perform the work of updating the routing table, among all of his/her other responsibilities.

Fast forward to today, and it no longer makes economic sense to have an expensive resource like a telecom engineer performing regular—monthly, weekly, or daily—updates to the contents of the routing table. Yet the complexity of the underlying software used to manage many older switches puts it beyond the reach of clerical personnel. Consequently, many providers are forced to continue with the old approach of semi-annual, quarterly or, at best, monthly updates to their routing tables, meaning that in many cases, their businesses are only profit-optimal between two and twelve days a year. The rest of the time, these service providers are leaving money on the table in the form of foregone profits, paying more than they need to in order to transport and terminate subscriber phone calls.

Optimizing the profitability of a given call, as well as the service provider's overall call volume, therefore requires a back-end system that lends itself well to frequent updates to the routing table. While such a system could in theory be operated by clerical personnel, many service providers would prefer to only have qualified technical personnel interacting with their switching architecture. In this case, the next best alternative is a system that allows detail-intensive work, such as the aggregation and interpretation of inputs to the routing table from multiple sources, to be performed by clerical personnel before ultimately being handed off to technical personnel for integration into the switching platform. The time spent by a technical resource on such updates should be minimized in order to most effectively leverage that person's skills and expertise.

BUILDING THE ROUTING TABLE

The information used to develop the routing table includes numerical data such as country codes, area codes (NPA), city codes, and even numbers down to the local telephone exchange (NPA-NXX); text information such as country names, switch IDs, and provider names; pricing information for the transport of the call over a partner's network as well as for the termination of the call at the remote carrier switch and, in some cases, the cost of 'dipping' into the directory database of a given carrier; and finally business rules. All of these can be considered inputs to the routing table, though some items of information will not be present in the final routing table itself, at least not in their original form.

These routing inputs are provided by the service provider's carrier partners in varying levels of detail and arrive in formats ranging from faxes and e-mail messages to Microsoft Excel worksheets, comma-separated values (CSV) in a text document, or raw XML data. Consequently, the aggregation of this information into a single, meaningful presentation is often a time-consuming manual process and is best-handled in many cases by tools such as Microsoft Excel or text editors that offer extensive find and replace capabilities, can perform logical operations, and can in many cases be configured to automate certain operations. Though powerful in nature, these tools can be utilized by clerical personnel or business analysts.

It is the decision about what to do with data inputs that completes the logic of the routing table. These decisions are essentially business rules that say '*when X is encountered, do Y*' or '*when A is encountered, do B, then C*', etc. In the case of these two examples, 'Y' and 'C' may represent basic decisions such as to send a call over a specific carrier partner's network. However, these business rules may also require additional logical operations such as 'B' to be performed before handing the call off to the carrier partner; for example, this could include the removal or the replacement of call data, such as that found in the calling number.

TELCOBRIDGES' TMEDIA CALL ROUTING PLATFORM

TelcoBridges has developed a call routing solution that meets the need of service providers for the simplified creation and timely maintenance of carrier data as well as both simple and complex call routing rules, which taken together constitute the routing table and contribute to enhanced service provider profitability. These advanced call routing capabilities are delivered with each and every member of the Tmedia family of VOIP gateways. This call routing platform builds on the powerful foundation of broad network connectivity choices, extensive support for concurrent signaling and control protocols, and wide variety of media handling options that have become the hallmark of Tmedia VOIP gateways.

Tmedia's call routing functionality is provided by a combination of carrier pricing data and call routing rules, some of which are generated manually and others that are generated automatically on the basis of carrier partners' service capabilities. We will examine the question of carrier data briefly before exploring the call routing rules functionality in much more depth in this section. In the section following this one, we will see the routing table in action.

The following table provides a simplified example of the type of carrier data that can be found in a routing table such as that provided with Tmedia; it uses fictitious pricing data from three real-world Canadian service providers with national footprints.

Carrier name	Rate	Relative weighting (in %)
Bell Canada	$ 0.05	30
Allstream	$ 0.04	40
TELUS	$ 0.03	30

In this case, we can see that each service provider offers a different rate (expressed in cents per minute) to transport a call across its network. The third column of the table indicates the ratio in which outbound calls should be spread across the different partner networks; this is used by carriers that seek to spread their business among different partners for volume discount, call quality, or business resiliency reasons. A more extensive example of carrier partner data would include information such as the cost-per-minute depending upon the time of day or the day of the week; the country code/area code/NPA-NXX of the calling/called numbers that were considered 'on network' (or not); and other factors. Tmedia's web based interface makes it easy to add additional columns to the routing table to capture such data.

The second major component of the routing table is call routing rules; these leverage the data in the routing table to perform the actual call routing. Tmedia offers two powerful means of generating such call routing rules: *manually* and *automatically*. The manual approach uses a series of pre-defined routing rules to determine where and how calls are transported to their destination. In TelcoBridges' terminology, manually-generated routing rules are known as *route scripts* and routing based on *route scripts* is described as being *static* in nature. Examples of *route scripts* that are included with Tmedia include:

- **Simple routing:** Simple routing: With this routing option, calls are routed on the basis of a series of ordered criteria (called number, calling number, incoming NAP, outgoing NAP). As initial criteria are successfully met, additional criteria are applied to generate a list of potential routes. The first route in the final route list is then used for the remapping of "called number", "calling number" and outgoing NAP to form the outgoing call parameters.

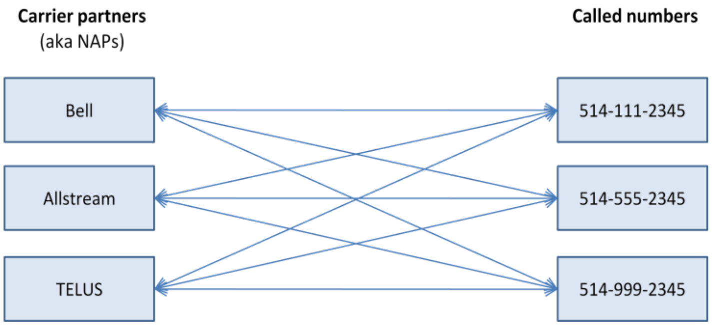
- **Simple least cost routing:** Similar to "simple routing", this routing option adds the ordering of routes on the basis of transportation costs, which can be assigned to each possible route. Before route-matching takes place, routes are ordered, lowest to highest, using the "cost" field of each route. The route with the lowest cost will then be used for the outgoing call.
- **Least cost routing:** A more advanced version of "simple least cost routing", costs are assigned on the basis of the time day. For each route, there are three possible time periods in a day. The route with the lowest cost at that specific time of day will be used for the outgoing call.
- **Percentage routing:** With this routing option, calls are routed among various possible carriers on the basis of a pre-determined percentage or ratio. For example, with three carrier partners, it may be determined in advance to route 50% of calls to the first partner, 30% of calls to the second, and 20% to the third partner. Routes are ordered by giving priority to routes whose destination NAP usage is farther from the desired usage.
- **Answer seizure ratio (ASR) routing:** this type of routing uses the success rate of connecting to a given carrier to determine if additional calls are routed to that carrier; a success rate falling below a certain threshold may mean that calls are no longer forwarded to that partner carrier for a given period of time

Manual routing rules can also be combined together in order to produce more advanced call routing functionality. In this case, a *routing script* is embedded in—or referenced by—another *routing script*.

These pre-defined manual routing rules remain in effect until such time as they have been modified by technical personnel. While it is easy to create a handful of such routing rules, the time required to generate and to maintain them increases quite rapidly as the number of carrier partners goes up and the number of potential situations or exceptions to be addressed increases as well.

In TelcoBridges' terminology, call routing rules that are generated automatically are known as *routesets* and routing based on such *routesets* is described as *dynamic*. A *routeset* links a country, area code, city, or telephone exchange (NPA-NXX) to one or more network access points (NAP) and for each carrier partner serving a given destination, there is a corresponding NAP. (Therefore, the *routeset* links one or more carrier partners to a specific country, area code, city, or telephone exchange.) Whereas the logic behind *route scripts* is defined in advance by TelcoBridges, and can be modified by the user, *routesets* are generated by the call routing platform itself on the basis of data obtained from carrier partners and imported into the system. Consequently, *routesets* are entirely specific to the service provider's situation and unique set of business relationships.
Using a *routeset*-based approach reduces by a factor of magnitude the number of potential routes to be evaluated during call routing before an optimal route is selected. Without *routeset*-based routing, the number of potential routes is essentially exponential, as a many-to-many relationship exists between NAPs and called numbers, as shown in the following figure:

If we apply this scenario to an example using numbers called on three different exchanges (NPA-NXX) on the island of Montreal, which is served by the three carriers we saw earlier, we obtain a total of nine (i.e., 3 x 3 = 9) potential routes to be evaluated, as shown in the following figure:

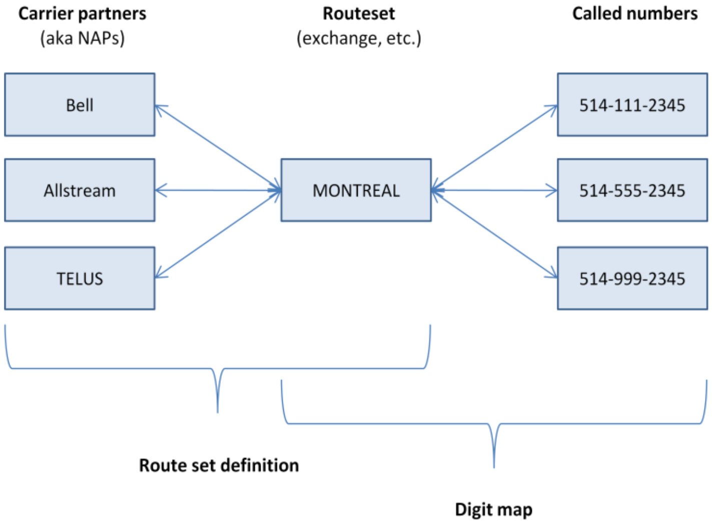


If we increase the number of different exchanges (NPA-NXX) to fifty, then there are one hundred and fifty (i.e., 3 x 50 = 150) potential routes to evaluate.

Using *routesets* enables us to drastically reduce the number of routes to be evaluated. In essence, the *routeset* approach breaks the connection between individual carriers and individual phone numbers. In this case the relationships between carriers and called numbers are modified into many-to-one and one-to-many relationships between themselves and the *routeset*.

In this example, the *routeset* is equivalent to a city; however, it could be any nomenclature—geographic or otherwise—down to the level of a given switch if that is required.

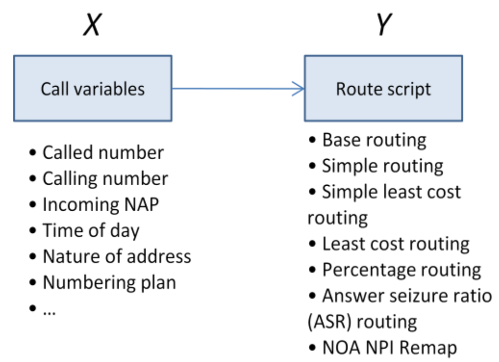
Adding the *routeset* to our current scenario produces the following result. Instead of the nine routes that need to be evaluated, there are now a total of three routes in all; one between each carrier and the routeset, known here as 'Montreal. Compared to the previous scenario, there are only one-third of the routes to be evaluated—a significant reduction.



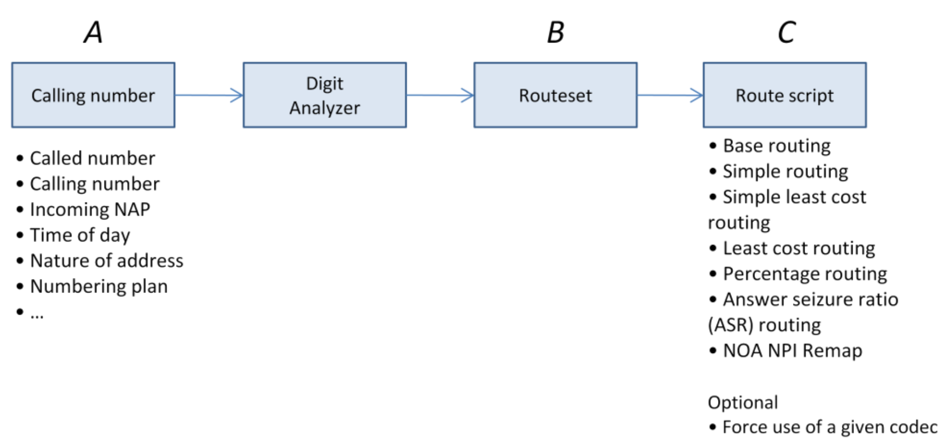
To simplify the creation of these *dynamic* routing rules, carrier partner data can be aggregated by clerical personnel using standard office application software such as Microsoft Excel. This data can then be exported as a series of files containing comma separated values (CSV), a standard interchange format for data, and then imported by technical personnel into Toolpack Web Portal, the web-based configuration and management application supplied with each Tmedia gateway. Once the source data has been imported into Toolpack Web Portal, it is parsed in order to generate the *routesets*. As new carrier partner data is captured or existing data is updated, the business rules defined in the routing table are updated in turn.

STATIC VERSUS DYNAMIC ROUTING

To better understand distinction between static (*routing scripts*) and dynamic routing (*routesets*), we will return to the two examples we saw earlier. The first example, described in the following figure and featuring element 'X' and operation 'Y', demonstrates static routing. It uses a series of business rules encapsulated in *routing scripts* in order to evaluate call data and determine a desired route. The presence (or absence) of one or more call variables (see bullet list on the left of the figure) is used to select an appropriate *routing script* (see bullet list on the right of the figure) in order to route the call.

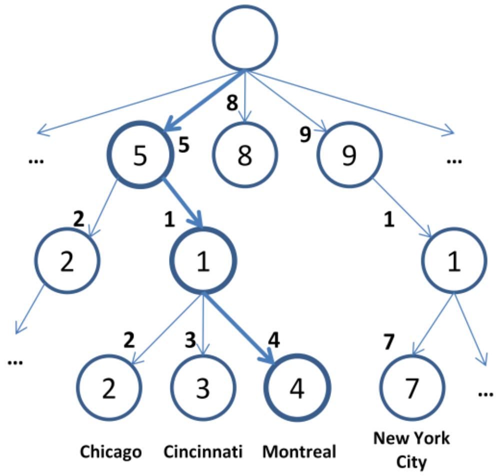


The second example, featuring element 'A' and operations 'B' and 'C', demonstrates dynamic routing. In this case, there are two additional elements or steps added between the identification of call variables and the choice of *routing script*. The first new element is the digit analyzer; the second is the *routeset*. Since we examined *routesets* earlier, we now turn our attention to the digit analyzer.



The digit analyzer is a non-linear pre-routing algorithm designed to find the optimal set of routes with which routing is to take place. It is based on an accepted approach known as 'trie' sorting, enabling it to support virtually unlimited numbers of routes, since routing is always performed on a sub-set of routes that match the destination telephone number. This is possible because all routes not required for routing the destination telephone number are screened out, which greatly enhances performance.

In the example below, condensed for space reasons, we attempt to solve for the 514 area code (NPA), which corresponds specifically to the island of Montreal, which is comprised of multiple cities sharing the same area code for wireline and mobile lines. In this case, the algorithm begins by solving for the first number, which is 5. Following that it solves for the second number, 1. In our simplified example, that leaves the digit analyzer with three possible choices of destination or *routeset*. Solving for the third number, which is 4, brings us to the *routeset* named appropriately enough 'Montreal', which corresponds to Montreal.



Continuing with our example, the *routeset* value 'Montreal' will then be analyzed for corresponding NAPs. In this case, a lookup in the routing table has identified three partner carriers that serve that particular destination. For each partner carrier, there are a series of values recorded in the routing table. From this point on, manual routing takes place as these values are fed to the *routing scripts*.

Montreal NAPs	Rate	Relative weighting (in %)
Bell Canada	$0.05	30
Allstream	$0.04	40
TELUS	$0.03	30

TMEDIA CALL ROUTING IN ACTION

Now that we have seen the different components of the routing table—partner data, *routing scripts*, and *routesets*—let's examine two example scenarios that tie these concepts together.

Static routing

The first example scenario involves a call destined for Brazil (country code 55). Our theoretical service provider has negotiated agreements—at fictitious rates—with four partners at the country level in order to terminate calls in Brazil. As a result, our service provider makes no distinction regarding whether calls are routed at the city level or at the level of a given exchange or switch. This makes routing quite simple and, as a result, the basic routing scripts supplied with Tmedia VOIP gateways are sufficient to meet the service provider's needs as such. Since our service provider is primarily concerned with cost, but with an eye on ensuring customer satisfaction, it will use a combination of least-cost routing and active seizure rate (ASR) routing. The latter of these two routing scripts will actually be the first step in the two-step routing process.

Under ASR-based routing, carrier partners are evaluated based on previous success in transporting and terminating phone calls; a minimum success threshold is specified in order to determine those partners towards which new calls will be forwarded for transport and termination. In our example scenario, our service provider has determined that in order to ensure customer service, an ASR rate of 70% or better is required. In this case, the first three carriers in the table have ASR completion rates above 70% and are therefore eligible for further consideration.

NAPs (carriers)	**Rate**	**Active Seizure Ratio (ASR)** (in %)
TIM	$0.051	75
iBasis	$0.047	90
Telefónica	$0.039	80
Transit Telecom	$0.028	60

At this point, the least-cost routing script is called into action. The three carrier partners that successfully passed the ASR calculation are now evaluated using the business logic of the least-cost routing script. Since the unmodified script is uniquely concerned with ensuring the lowest call for a given call, it will therefore choose to forward the call to Telefónica, since that carrier's per minute rate for connection to Brazil is the lowest.

Dynamic routing

In our second example, a subscriber dials a friend in the United States (country code 1), specifically in the city of Los Angeles (area code 213). In this case, our service provider has not only negotiated a number of carrier relationships for the United States, but due to the depth and breadth of that country's telecommunications market, it has a series of relationships in place that are essentially geography-specific. Therefore in order to terminate calls in the 213 area code, the service provider can choose between various international, national and regional service providers with points of presence in Los Angeles.

After receiving the called number (+1-213-555-2345), and determining the appropriate country, the digit analyzer attempts to solve for the appropriate routeset. As we indicated in our earlier discussion of the digit analyzer, the algorithm begins by solving for the first number, which is 2. Following that it solves for the second number, which is 1. At this stage, that still leaves ten possible area codes ranging from 210 to 219, including prominent cities such as New York (212), Los Angeles (213), Dallas (214), and Philadelphia (215). Solving for the third number, which is 3, brings us to the *routeset* that corresponds to Los Angeles (213). As the table below indicates, there are five unique carrier partners that serve the 213 area code; therefore there are five different network access points.

NAPs (carriers)	**Rate**	**Active Seizure Ratio (ASR)** (in %)
AT&T	$0.030	75
Verizon	$0.021	90
NTT America	$0.019	80
BT Global	$0.025	60
Velocity Networks	$0.022	90

Once the appropriate routeset (Los Angeles) is chosen, the applicable (static) routing script is called into action. In this case, during normal business hours, our service provider is only concerned with the absolute cost per minute to transport the call, and thus it uses least cost routing to determine the appropriate carrier partner. (Consequently, the ASR information in the routing table will be ignored.) Based on the (fictitious) information contained in the routing table, NTT America will be selected by the least-cost routing script as the appropriate provider for the transport and termination of the subscriber's call. The call is therefore routed to the NTT America NAP.

BENEFITS

Tmedia's call routing platform offers a number of benefits to service providers. Foremost among them is the ability to rapidly create and maintain the routing table, which is arguably the principal factor in optimizing the profitability of subscriber calls. Part of the core media gateway application that ships with every Tmedia VOIP gateway, this call routing platform leverages the data and text manipulation capabilities of software applications such as Microsoft Excel to put the creation and maintenance of routing table inputs squarely in the hands of clerical personnel. The ability to leverage such personnel frees up technical resources while also accelerating the frequency and timeliness of updates to the overall routing table.

A second major benefit is that the creation and maintenance of the routing table itself can be highly automated. While this is ultimately the responsibility of technical personnel, such as telecom engineers, Tmedia's call routing platform removes a lot of the guesswork associated with creating optimal call routes and ensuring that all scenarios are addressed, as well as reducing the tediousness associated with routing table maintenance. As inputs to the routing table are updated with new pricing and destination information from partners, the table itself is updated and optimized, with new routes being added or removed as carrier business partner relationships evolve.

A third major benefit is flexibility. Thanks to the Ruby-based scripting engine at the heart of the Tmedia call routing platform, it is possible to customize the included call routing scripts to meet your specific needs; to create new scripts from scratch; and to embed routing scripts within other routing scripts for ultimate call routing control.

Finally, the call routing platform included with every copy of TelcoBridges' Media Gateway application provides superior performance. The *routeset* approach, combined with the digit analyzer, enable the Tmedia call routing platform to handle very high numbers of call routes, with no noticeable loss of performance.

CONCLUSION

The Tmedia call routing platform addresses the needs of service providers looking to optimize and keep optimized the profitability of individual calls and their overall call volume. It makes use of the skill sets, expertise, and relative availability of different categories of service provider personnel to simplify the entry and management of inputs to the routing table, the generation of calling routes, and the application of optimized call routes in a production environment. For more information regarding Tmedia's powerful approach to call routing in general, and routeset routing in particular, please contact your TelcoBridges business partner or your TelcoBridges account manager.

BACKGROUND INFORMATION: RUBY SCRIPTING

The technology behind the call routing capabilities of Tmedia is the Ruby scripting language. Scripting in general, and Ruby in particular, are recognized as a powerful approach for manipulating and acting upon data of all types. One of the advantages of scripting, aside from its natural language syntax, is that it provides much of the performance and many of the capabilities associated with traditional software programming languages, but without the laborious need to compile software code. As a result, users do not need to be trained software engineers to take advantage of the power of the Ruby scripting language. (TelcoBridges also uses scripting for its support for the CAS R2 signaling protocol. That implementation leverages the Lua language to simplify the creation of region-specific protocol variants.) More information on Ruby is available at www.ruby-lang.org

BACKGROUND INFORMATION: STATIC VS. DYNAMIC

To better understand the difference between static and dynamic, an analogy may be helpful. In this case, an analogy can be made between static and dynamic routes and static and dynamic web sites. A static web site contains individual web pages (HTML) that were created manually and saved to a web server. A dynamic web site builds web pages automatically by drawing on information in different database tables and combining it with a template to create a web page that is then saved to a web server. In the case of dynamic routing, this refers to carrier and destination data that is taken from different CSV-formatted files and combined to generate the routing table. Once generated, the routing table itself remains static (or fixed) in nature until it is generated again. In TelcoBridges terminology, dynamic routing is represented by a routeset.

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ABOUT TELCOBRIDGES

TelcoBridges is clearly defining the future of telecommunications technologies. With the industry's premier unified hardware platform for network convergence, value-added services, and performance management, TelcoBridges is enabling service providers to meet and exceed their service goals while ensuring exceptional operating cost-efficiency. TelcoBridges' channel partners, including value-added resellers, system integrators and solution developers, have delivered and deployed carrier-grade solutions in over 50 countries around the world. These include VoIP gateways, mobile value-added services, unified communications, network monitoring, lawful intercept, location-based services, and many others. For more information, please visit http://www.telcobridges.com/

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