Managing Costs in Growing Networks with SEGway™ STPs and Point Code Emulation™

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Introduction

Voice networks are evolving from traditional circuit switched networks proliferated with legacy switches, to IP-based networks populated by softswitches and IP application servers. In addition, the emergence of VoIP and new service offerings and applications for wireline and wireless customers is driving network growth. The rapid change of what has traditionally been a relatively stable network is creating stress on service providers and network infrastructure unlike anything they've experienced in some time.

A significant operational effort is required to commission and provision new switches, and migrate traffic off of well ensconced legacy equipment. Translation and signaling routing information must be disseminated and carefully coordinated across all carriers to ensure uninterrupted service for customers.

Service providers that are expanding their services and adding new switches need to obtain a new point code for and set up routing to each node. Operationally, this activity requires careful planning, coordination between carriers and multiple service orders to update switch data across the network. While adding a single switch may be manageable, carriers who envision future growth are concerned with managing this effort.

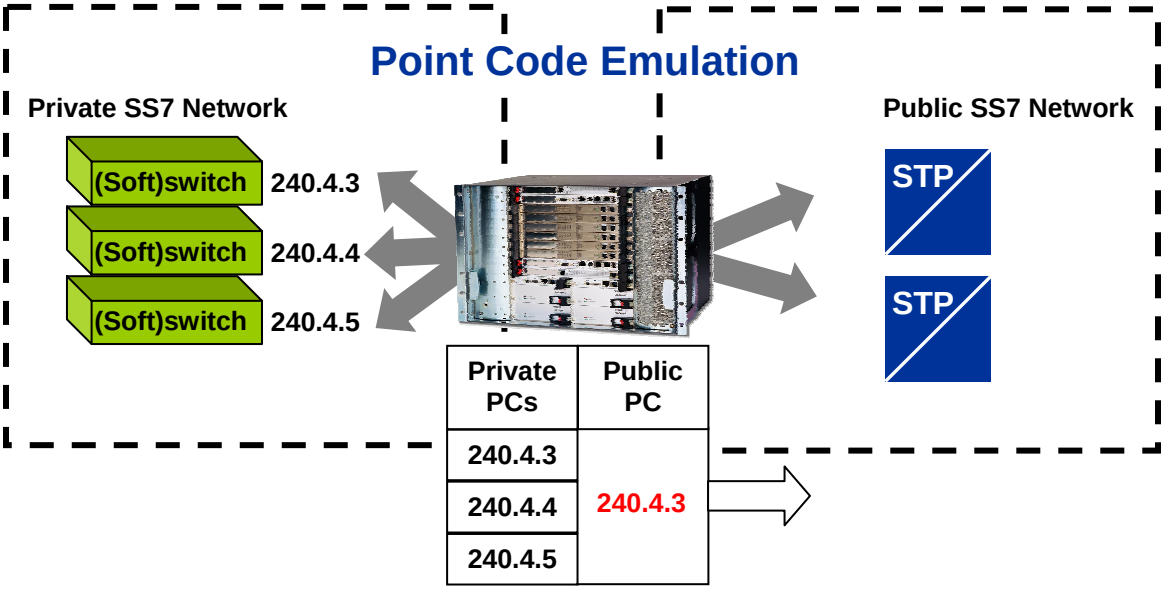
In many countries worldwide, point codes are a scarce resource that is very costly to obtain. In fact, carriers may experience growth constraints as a result of their inability to secure additional point codes.

The concept of building and managing a private network with multiple node elements while presenting a single public entity is not a new one - one need only look to an IP network and the use of Network Address Translation (NAT). NAT (commonly used in IP networks) is a technique for transparently mapping an IP address or range to another IP address or range. Any routing device situated between two endpoints can perform this packet transformation.

Within the SS7 protocol, there has not been an equivalent offering to NAT; however, there exists a clear need for this capability. Functionality comparable to NAT within the SS7 domain would offer carriers the opportunity to reduce operational costs significantly and minimize the number of public point codes required to serve growing networks. To address this need, Performance Technologies has introduced Point Code Emulation™ (PCE) as an option on our SEGway family of STPs.

What is Point Code Emulation?

Point Code Emulation is an SS7 routing feature that offers simplified re-configuration and management of SS7 network elements. PCE establishes a virtual private SS7 network where network elements can be privately managed completely under the control of the service provider. To the public switched telephone network (PSTN), this private SS7 network and all nodes within it, assumes the identity of a single public point code.



Just as NAT on an IP-router allows private nodes to be managed transparently to the external IP network, PCE does the same for SS7 nodes. No public network reconfiguration is required as additional nodes are added or retired from service. Reconfiguration of SS7 network topology is minimal and interconnectivity to other service providers is preserved.

While the diagram above only illustrates PCE representing a single public point code, the PCE node is capable of representing multiple point codes within the public network. PCE has the flexibility to map point codes in a 1:n, n:1 and n:m configuration.

PCE serves to address key problems facing service providers today, including:

- **Migration of point codes from one switch to another:** Carriers retiring legacy gear, redeploying services to a new switch or finding themselves in a "cap and grow" scenario can take advantage of PCE's ability to perform seamless, low risk and controlled traffic migration.

- **Softswitch scalability:** Associating multiple switches with a single point code allows service providers to transparently grow switch capacity. This ability to "share" a point code provides enormous benefit to carriers by eliminating the need to reconfigure SS7 routing tables in switches within the SS7 network.

- **Switch trunking limitations:** PCE alleviates physical trunking limitations often seen in SS7 networks where F-links are prevalent.

How Does Point Code Emulation Work?

Point Code Emulation is based on the concept of defining a gateway node that resides on the boundary of two networks - a public SS7 network (PSTN) and a private SS7 network. The PCE application manages messages transiting between these networks in several ways and should be capable of handling (at a minimum) both ISUP and TCAP traffic.

ISUP Message Handling

Incoming ISUP messages from the PSTN are received by the gateway node. Translation tables within the node define remapping of the destination point code within these messages to a private point code based on the OPC and a range of circuit identification codes (CICs). The original Destination Point Code is overwritten within the message and then routed through to the correct node within the private network.

Outbound ISUP messages sent by a private node destined for the public domain are remapped in a similar fashion, with the private OPC replaced with the point code known to the public network.

When a new node is added or removed within the private network, the gateway is reconfigured through assignment of CIC ranges to transparently redirect traffic to or from the private node.

In this manner, PCE allows traffic migration to occur in a controlled, low risk fashion by moving individual trunks or whole trunk groups. A small set of inter-machine trunks can be established between the private nodes during this migration to facilitate in-progress traffic.

ISUP Management Message Handling

The PCE application is also responsible for handling ISUP management messages should a private point code become inaccessible for some reason. Circuit Group Blocking message(s) (CGB) for the assigned CIC range is returned to the public network. Standard transfer signals (TFx) are used to notify other nodes within the private network.

Messages arriving at the gateway where the CIC is undefined will be handled by returning an unequipped circuit identification code (UCIC) to the message originator, and then discarding the message.

TCAP Message Handling

TCAP message routing uses rules that rely on a mixture of dynamic data and static provisioning. TCAP messaging is primarily transaction based, involving queries and responses. As a general rule, the PCE application learns the origin, destination, and transaction ID of the message from the incoming query, stores this information temporarily in memory, and uses it to route the associated response with the appropriate values to the originating node. As transactions are unique on a per-OPC and Transaction ID combination, the PCE can key on these fields to accurately restore the original context of the message when responses are processed.

As for the incoming query, routing these messages is dependant on both the application and network design scenario. Generally, a fixed, one-to-one mapping between point codes on either side of the PCE is sufficient to cover most routing cases. In the event where services are distributed between multiple nodes, the mapping can use the advanced routing capabilities of GTT. In other cases, the query is multicast to all switches, with the concerned node accepting the message and processing it appropriately.

What Problems Does Point Code Emulation Address?

Safe, controlled switch replacement

As legacy switches reach end-of-life, a decision is often made to replace the node with a new soft-switch. Point Code Emulation transparently facilitates this activity by allowing carriers to migrate traffic in a controlled manner from the legacy switch to the replacement node without the addition of a new point code, gradually rerouting traffic off existing trunks. During this transition, both the legacy node and the replacement node will co-exist using the same point code. To the SS7 network, these two nodes appear as a single entity (point code) with traffic distribution controlled by the PCE node. Outbound messages from these nodes will present the same Originating Point Code (OPC).

By allowing nodes to share a single point code, carriers eliminate the need to re-provision nodes in their network to route to a new point code associated with a new switch. As such, service activation can be reduced from months to weeks, providing significant logistics and resources savings.

Using PCE, carriers can migrate traffic from the legacy node to the new switch by trunk group or other logical grouping. This facilitates a controlled, low-risk cut-over that is transparent to the rest of the carrier's network. Without PCE, carriers must

"flash-cut" trunks and signaling links from the legacy node to the replacement switch, which is both logistically challenging and presents a high risk for service disruption.

Managing an evolving network transparently

As existing nodes reach capacity in growing VoIP networks, carriers add new softswitches. Each time a new softswitch is provisioned, its presence must be propagated throughout the SS7 network to each node. Carriers may also need to provide this new node information far beyond their local nodes. Turning up service to these nodes requires establishing voice trunks to the nodes as well as SS7 network configuration to be able to successfully route traffic. Propagation of this routing data is labor intensive, time consuming and costly as new routes and routesets are provisioned in each SS7 node.

When network topology changes are required, Point Code Emulation addresses the challenges associated with the provisioning and activation of new nodes in the SS7 network. PCE significantly reduces the risk associated with node/network reconfiguration by allowing for a controlled step-by-step migration of SS7 traffic and trunks. This drastically reduces the provisioning and configuration of SS7 data required to establish signaling links between nodes. In turn, this reduction of effort results in significant labor savings.

F-link consolidation

In some countries (particularly Europe), common practice has been to deploy a fully associated SS7 network where every switch has SS7 connection(s) and F-links to all other switches in that network. This type of network requires large numbers of individual SS7 links per node, which can create physical interconnection challenges as networks grow and new nodes are put into service.

Deploying new nodes into an existing SS7 network can be expensive, as a new point code must be acquired for each nodal element. A new element's point code and routing information must also be propagated into the SS7 network, which can be an administrative-intensive activity involving numerous carriers. In addition, due to the proliferation of SS7 nodes in some areas of the world, point code exhaustion is a serious concern.

ITU SS7 networks, which have historically been configured in a fully meshed topology using F-links, are ideally suited for the PCE solution. Nodal growth in a fully meshed network with "N" nodes involves the addition of N-1 SS7 links each time a new node is commissioned. Once deployed, the PCE node masks the addition of new nodal elements and no additional public point codes or corresponding F-links are required. The addition of new nodes is seamless, inexpensive and can be brought into service much quicker. PCE also allows F-link connections to be maintained and physically consolidated into a single node, which eliminates the interconnection challenges common in a fully associated network.

Deploying PCE in a network configured with F-Links will also provide additional trunking facilities savings where tandem switching is required. With PCE, trunking

facilities terminate directly on a higher level Class 4 Office, resulting in fewer trunk terminations and line cards by eliminating additional hops through local Class 4/5 switches.

Alternatives to Point Code Emulation

Several offerings are available that provide functionality similar to that of Point Code Emulation. One implementation offers a one-to-one, public to private point code mapping capability. This alternative provides neither point code conservation nor operational efficiencies due to reduced provisioning requirements. On the other hand, PCE offers “N’ to “M” point code mapping between public and private networks and the ability to hide multiple point codes within the private network.

Another alternative is SRP (Signal Relay Point), which is commonly used for A-link consolidation. An SRP node is able to generate transfer signals about the nodes it is front-ending, and discriminate transiting messages. However, SRP nodes require extra SS7 ports. Provisioning and maintaining an SRP node is generally complex, because there is no operational optimization resulting from the ability to configure and maintain nodes within a private network. SRP does not offer any point code conservation, as all subtending nodes still require public point codes. Within North America, point codes are assigned in groups of four, and operational considerations are required when new point codes do not align with a carrier’s existing numbering plan.

Conclusion

As networks continue to grow and evolve at a rapid pace, infrastructure cost pressures are a reality in today’s market both from a capital and operational expenditure standpoint. Point Code Emulation directly addresses both of these issues by reducing hardware requirements, and significantly simplifying and de-risking network reconfiguration efforts.

The inherent risks associated with retiring legacy equipment, migrating traffic to new switches and expanding capacity through the addition of new network elements is mitigated. There is no need to flash cut facilities when Point Code Emulation is deployed in a network. De-risking such activities is paramount in a telephony environment.

Point Code Emulation is available as an optional feature on Performance Technologies’ SEGway™ STPs. Service providers and softswitch vendors alike are realizing the significant monetary and operational value this unique feature offers, whether as a permanent deployment consolidating switches, or as an interim node migration solution.

For more information on Performance Technologies and our SEGway signaling solutions or to book a demonstration, please contact sales@pt.com.