NENA

Impacts of Using a Common Trunk Group to Carry Calls of Multiple Service Types into a Legacy Selective Router

Technical Information Document

(TID)

Impacts of Using a Common Trunk Group to Carry Calls of Multiple Service Types into a Legacy Selective Router

NENA 03-508, Version 1, March 15, 2010

Prepared by:
National Emergency Number Association (NENA) Network Technical Committee & Multiple Service Type Calls Working Group

Published by NENA
Printed in USA

NENA
TECHNICAL INFORMATION DOCUMENT

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NENA's Technical Committee has developed this document. Recommendations for change to this document may be submitted to:

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Acknowledgments:

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NENA recognizes the following industry experts and their companies for their contributions in development of this document.

Version 1, Approval Date, 03/15/2010

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This committee would also thank Roger Hixson (NENA Technical Issues Director) and Rick Jones (NENA Operational Issues Director) for their support and assistance.

TABLE OF CONTENTS

1 Executive Overview

This document provides a review of the topics that are associated with the practice of delivering more than one type of an emergency call over the same trunk group into a legacy type E9-1-1 selective router. It describes the market forces leading to the implementation of the practice as well as the technological pros and cons associated with it. The technical and operational implications of the practice are addressed from the perspective of many separate areas, including groups such as the originating service provider, network aggregator, E9-1-1 system service provider, Public Safety Agency (i.e., PSAP management/call takers), and regulatory bodies that govern 9-1-1 operations.

There are multiple reasons why service providers may wish to combine traffic on one common trunk group, such as managing fewer trunk groups, increased efficiency of call processing, and associated cost savings to all network entities. It also helps facilitate the advancement of efficient and cost effective delivery of emergency calls based upon emerging technologies and recognizing the convergence of consumer communications and devices, such as telematics, Mobile Satellite Services, Femtocells, Unlicensed Mobile Access, Fixed Mobile Convergence, etc.

Systems commonly referred to as "legacy" 9-1-1 deliver calls to traditional E9-1-1 selective routing switches over a dedicated network using trunks unique to each originating provider or service type. If one or more of these originating services is combined with another and placed onto a common trunk group into the E9-1-1 Selective Router, there could be consequences that could impact routing, default routing, and congestion control. Instances where calls of multiple service types route over a common trunk group can occur when a carrier combines traffic of more than one service type on a trunk or when a service aggregator combines traffic from more than one carrier on a trunk. A flowchart is provided that can be used by interested parties to assess if combining traffic on a common trunk group is an option in their particular system, area or regulatory climate.

This document does not address other network configurations such as originating carriers that connect directly to PSAPs without going through a selective router or into an IP or Next Generation network that performs the selective routing function differently than the traditional, legacy, E9-1-1 type network design.

2 Introduction

2.1 Operational Impacts Summary

Today, calls that are delivered to an E9-1-1 service provider's selective router often use a trunk group that only carries calls associated with one service type (i.e. wireline, wireless, or VoIP). In other instances, more than one service type such as wireline, wireless, VoIP, telematics, etc., are being combined with other traffic on common trunk groups to the selective router. In the E9-1-1 PSAP network today, some PSAPs may only take calls for a particular call type (i.e., wireless calls only), or may be taking calls from all call types throughout their service area. Market forces, competition, advancements in signaling technology, and addition of new and advanced services are many reasons why a carrier/aggregator would want to use a common trunk group for calls from

multiple service types. The use of a common or multi-service trunk group into an E9-1-1 selective router is becoming an evolutionary path, and can help support efficient and timely introduction of these new services.

There is a need for the various business parties to assess their operations to see if adjustments are needed. For example, normal call processing may be business as usual. Anomalies such as alternate routing and default routing may be addressed as one aspect of introducing such new service types. PSAP operations, 911 system service providers and originating carrier operations may all be impacted when common trunk groups are utilized by the originating carrier or aggregator to send calls to the selective router. In the unlikely event that a call is default routed, the selected default PSAP would receive calls from multiple service types based upon the default route that has been provisioned in the legacy selective router. Originating carriers and aggregators will need to work with the 9-1-1 Authority and E911 system service provider in order to define default routing strategies to address these challenges.

There are technical implementation details that are described later in section 3 that outline the responsibilities associated with the use of common trunk groups. Since PSAP, selective router and originating carrier operations are all impacted by the use of shared facilities; technical, operational, local and national policy guidelines will need to be considered during the decision process to use common trunks. A full impact analysis is a critical part of the decision process.

2.2 Security Impacts Summary

No security risks have been identified.

2.3 Document Terminology

The terms "shall", "must" and "required" are used throughout this document to indicate required parameters and to differentiate from those parameters that are recommendations. Recommendations are identified by the words "desirable", “should” or "preferably".

2.4 Reason for Issue/Reissue

A technical information document regarding the technical implications of sending calls from multiple service types over a common trunk group to legacy E9-1-1 selective router(s) has never been published. This TID provides enough technical detail such that the various experts can understand the impact on the various entities of using a common trunk group.

NENA reserves the right to modify this document. Upon revision, the reason(s) will be provided in the table below.

Version	Approval Date	Reason For Changes
Original	**03/15/2010**	**Initial Document**

2.5 Recommendation for Additional Development Work

There is no recommendation for additional development work required.

2.6 Date Compliance

All systems that are associated with the 9-1-1 process shall be designed and engineered to ensure that no detrimental, or other noticeable impact of any kind, will occur as a result of a date/time change up to 30 years subsequent to the manufacture of the system. This shall include embedded application, computer based or any other type application.

To ensure true compliance, the manufacturer shall upon request, provide verifiable test results to an industry acceptable test plan such as Telcordia GR-2945 or equivalent.

2.7 Anticipated Timeline

The decision and the timeframe to implement common trunks is made among the originating carrier/aggregator that is proposing multiple service types on a common trunk group, the E9-1-1 service provider(s), and the 9-1-1 Authority(ies). The timeframe of each implementation is set by these entities.

2.8 Costs Factors

The practice of combining different types of traffic on a common trunk group will have different impacts depending on what perspective you look at it from. In general in analyzing cost factors, there are savings associated with a lower number of trunks and trunk groups between an originating carrier's/aggregator's network and an E9-1-1 service provider's selective router versus the need to build out separate trunk groups for each service type and new services to be implemented. However, billing and cost recovery for providers or 911 Authorities could also be impacted by the amount of circuits installed, or used, so those factors may need to be considered in the decision making process as well.

Network modifications to consolidate service types over a common trunk could also have costs or savings associated with making or processing the change. In analyzing cost factors, the originating carrier/aggregator, E9-1-1 service provider, 9-1-1 Authority, or any other entity involved independently analyze their costs and efforts associated with the change versus the savings associated with facility reduction. For example, if reconfiguration and decommission of existing trunks are required to migrate connectivity to a common trunk group, costs associated with current term and termination liability are factored into the analysis.

Cost savings can be achieved in trunk reductions, switch ports reductions, transmission equipment reduction, backhaul expense reduction, and in other parts of the architecture that are in the call path, but these savings could be weighed against other costs, such as potential increases in administrative costs.

These potential cost savings might be realized by the carrier or the E9-1-1 Authority depending on cost recovery regulations.

2.9 Future Path Plan Criteria for Technical Evolution

In present and future applications of all technologies used for 9-1-1 call and data delivery, it is a requirement to maintain the same level or improve on the reliability and service characteristics inherent in present 9-1-1 system design.

New methods or solutions for current and future service needs and options should meet the criteria below. This inherently requires knowledge of current 9-1-1 system design factors and concepts, in order to evaluate new proposed methods or solutions against the Path Plan criteria.

Criteria to meet the Definition/Requirement:

1. Reliability/dependability as governed by NENA's technical standards and other generally accepted base characteristics of E9-1-1 service
2. Service parity for all potential 9-1-1 callers
3. Least complicated system design that results in fewest components to achieve needs (simplicity, maintainable)
4. Maximum probabilities for call and data delivery with least cost approach
5. Documented procedures, practices, and processes to ensure adequate implementation and ongoing maintenance for 9-1-1 systems

This basic technical policy is a guideline to focus technical development work on maintaining fundamental characteristics of E9-1-1 service by anyone providing equipment, software, or services.

2.10 Cost Recovery Considerations

Normal business practices shall be assumed to be the cost recovery mechanism.

2.11 Additional Impacts (non cost related)

The information or requirements contained in this NENA document are known to have both technical and operational impacts, based on the analysis of the authoring group. The primary impacts include:

a. Potential changes in policy, operation and/or call setup for originating carriers/aggregators

b. Changes that could impact E9-1-1 System Service Providers including selective router translations, cost recovery, call accounting, etc

c. Changes in the processes for delivery and / or operation of handling call anomalies to PSAPs

d. Call queuing priorities for callers may be impacted if a call to a selective router is transported by a multi-service trunk group.

2.12 Intellectual Property Rights Policy

NENA takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights.

NENA invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard.

Please address the information to:

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2.13 Acronyms/Abbreviations

Some acronyms/abbreviations used in this document have not yet been included in the master glossary. After initial approval of this document, they will be included. See NENA Master Glossary of 9-1-1 Terminology located on the NENA web site for a complete listing of terms used in NENA documents.

The following Acronyms are used in this document:		
Acronym	**Description**	**** N)ew (U)pdate**
ALI	Automatic Location Identification	
ANI	Automatic Number Identification	
ATIS	Alliance for Telecommunications Industry Solutions	
ESQK	Emergency Services Query Key	
ESRK	Emergency Services Routing Key	
NENA	National Emergency Number Association	
PSAP	Public Safety Answering Point	
SR	Selective Router	

The following Terms and Definitions are used in this document:		
Term	**Definition**	**** N)ew (U)pdate**
9-1-1 Service Area	The geographic area that has been granted authority by a state or local governmental body to provide 9-1-1 service.	
Aggregator	An entity that takes calls of multiple traffic types or calls from multiple carriers and combines them on a trunk group to the selective router. A carrier may provide aggregation functions for their own network, or an entity can provide aggregator services for their clients.	N

The following Terms and Definitions are used in this document:		
Term	**Definition**	**** N)ew (U)pdate**
Call Queuing	The method of selection of which calls get passed to the outgoing trunk group when there are more call originations than terminating members on the outgoing trunk.	N
Common (or Shared) Trunk Group	A trunk group that carries calls that originates from more than one service type or more than one carrier.	N
Congestion Control	A method of controlling traffic when there are insufficient resources to meet demand, for example more requests for calls than there are trunks. It may be achieved by rejecting requests, and/or diverting calls.	N
Transport Facility	An analog or digital circuit that connects switches and/or networks together. In this document, this refers to a digital trunk that carries calls between either the carrier network and the SR, or the SR and the PSAP.	N
Originating Carrier	An entity that provides telecommunications services to the end user.	N
Service Provider	An entity providing one or more of the following 9-1-1 elements: network, CPE, or data base service.	
Service Type	A broad definition to describe different originating networks types. Examples are wireless, wire line, cable, IP, etc. Calls can be classified by their service type	N

3 Technical Description

This section outlines the technical considerations for interconnection and routing between originating carriers'/aggregators' networks and the legacy E9-1-1 selective router.

For purposes of this document, we make the following assumptions:

Interconnections may be direct connecting circuits between the networks, aggregated at the physical level (i.e. transport facilities) or logically aggregated where multiple service types are delivered across a common trunk group.

Call routing uses legacy techniques where the pANI (TN/ESRK/ESQK) is associated with a PSAP and a call is delivered to that PSAP.

Calls may be alternate routed if the Primary PSAP cannot be reached, e.g. all trunks busy.

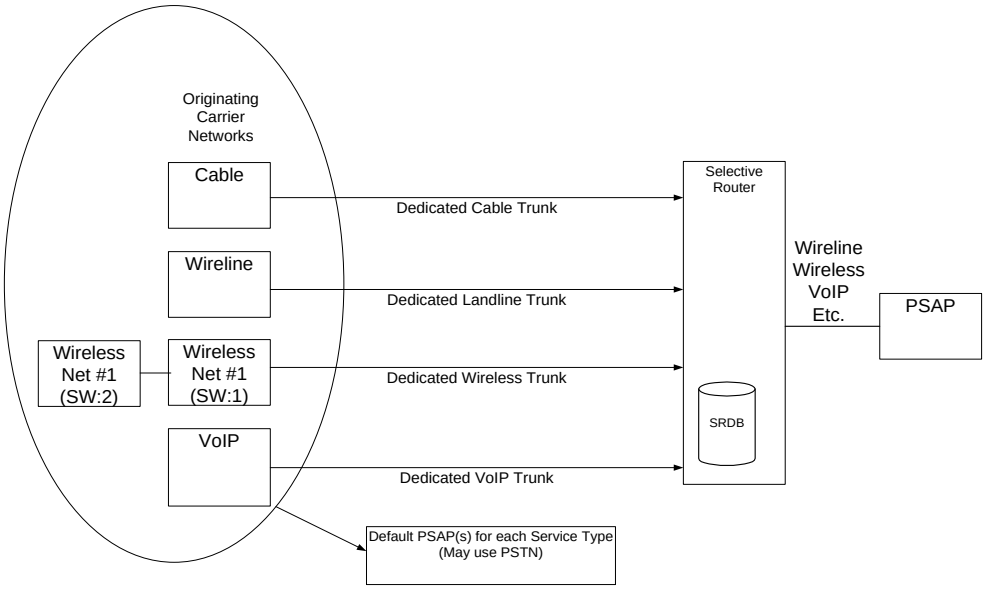
Calls may be default routed if there is an error in determining the Primary PSAP such as in the unlikely event that the ANI is missing from the call (ANI failure), No Record Found, data provisioning error, etc.

3.1 Carrier/Aggregator Configurations

Three (3) carrier/aggregator to selective router interconnection configurations are described below to help depict the architecture associated with a common trunk group. In these examples, aggregator is a network entity that takes calls of multiple traffic types or calls from multiple carriers and combines them on a trunk group to the selective router. A carrier may provide aggregation functions for their own network, or an entity can provide aggregator services for their clients.

3.1.1 Carrier using dedicated service specific trunks to a selective router

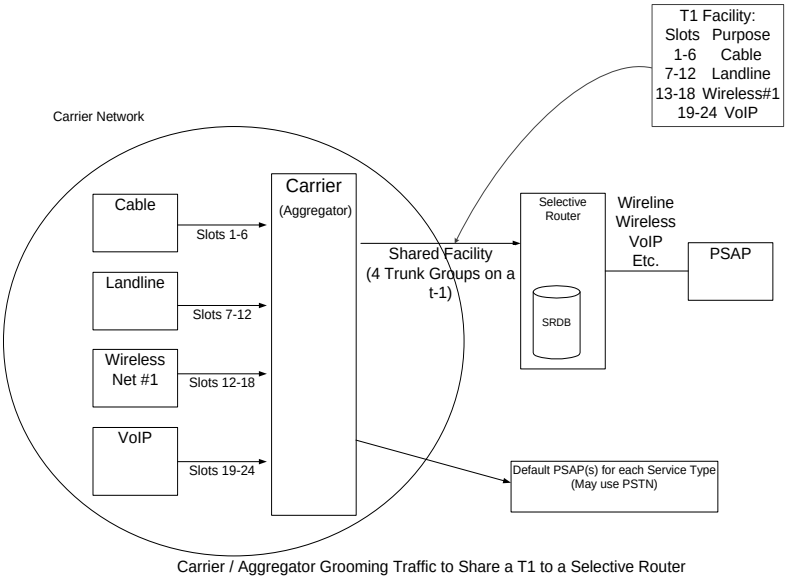
Current carrier to selective router interconnection typically consists of, at a minimum, one trunk group to a selective router from each switch that requires access to the PSAPs that are homed to that selective router. Typically, a single traffic type is carried on this dedicated trunk group. Traffic carrying similar service type calls from multiple switches may be combined by the originating carrier.



Carriers Using Dedicated Service Specific Trunks to a Selective Router

3.1.2 Carrier/Aggregator grooming traffic onto multiple trunk groups on a single digital facility

Originating carriers may engage in business arrangements with an aggregator to use a shared digital facility to interconnect to a selective router. In this case, the aggregator can assign multiple distinct trunk groups on the same digital facility on behalf of the originating carrier. The digital facility may contain calls from different traffic types and calls may be routed to different PSAPs, if the PSAPs are homed to the same selective router. The key here is that these are distinct trunk groups on the same digital facility.



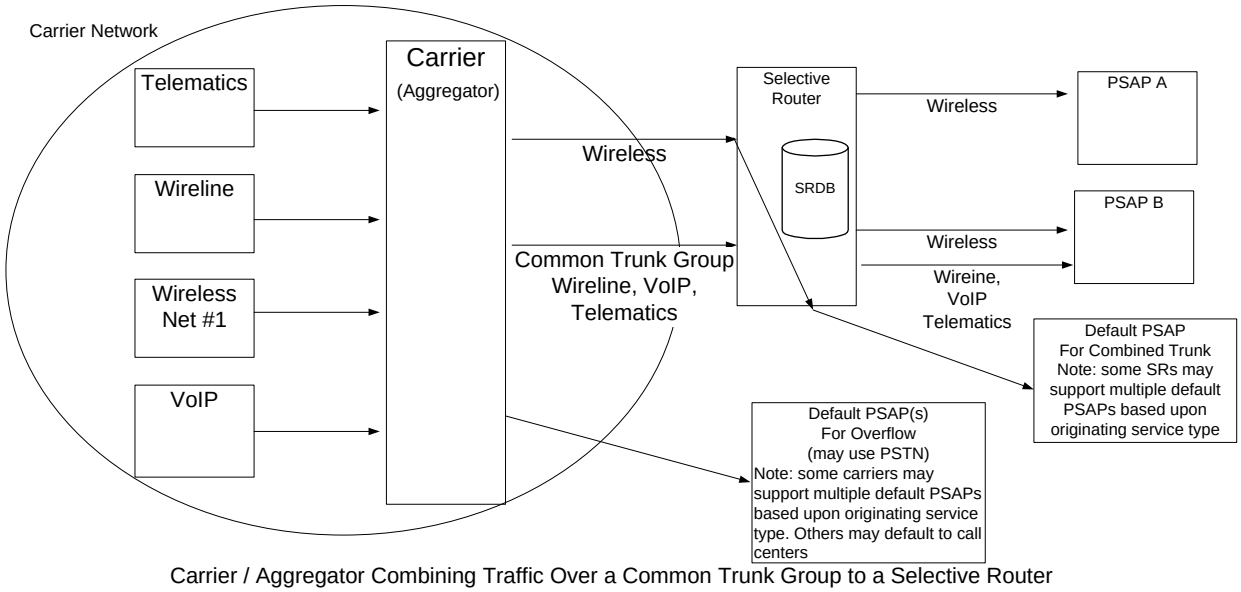
Carrier / Aggregator Grooming Traffic to Share a T1 to a Selective Router

3.1.3 Originating Carrier/Aggregator combining traffic to a common trunk group to a selective router

Originating carriers may engage in business arrangements with an aggregator(s) to route calls over their network and combine traffic on a common trunk group that connects to the selective router. In this case, the originating carriers deliver their calls to the aggregator and the aggregator uses its peering network to route the calls to the selective router via a common trunk group. An aggregator may combine traffic of various service types onto a common trunk group. An originating network service provider may use multiple aggregators and an aggregator may provide service to multiple originating carriers. Originating carriers may be different entities from aggregators and in some cases the originating carrier may have their own aggregator and provide a similar interconnection to the selective router. An example of this is originating carriers that are introducing Fixed Mobile Convergence (FMC) services that offer multiple service types within their service footprint. The common attribute here is that all of the traffic from multiple service types on the same trunk group will be directed to the appropriate PSAP via the selective router. This is the true definition of "common" trunk group as used throughout this TID.

The diagram below depicts one possible configuration. There are numerous other configurations currently in use that have been implemented or that are being proposed in the industry. This figure shows multiple carriers using a single aggregator to route calls to the PSAP. The originating carrier, e.g. telematics, may deliver its 9-1-1 calls to a point of presence of the aggregator. The aggregator uses its peering network to route the call to the selective router. In the figure, service types of wireless, wireline, VoIP and telematics are combined on a common trunk.

In the figure PSAP A only supports wireless calls while PSAP B supports all service types. Separate trunks for wireless are shown to PSAP B, however they could be combined such that all service types route across a single trunk group (e.g. CAMA trunks). Alternate PSAPs, not shown in the diagram, may receive calls when calls cannot be delivered to the PSAP (e.g. due to trunks busy). Alternate routing strategies are assigned in the selective router and are associated with the trunk group to the PSAP. Default PSAPs may be assigned to receive calls in the event that there is not sufficient information to determine the Primary PSAP. Based upon local agreements, the aggregator may have default routing strategies to deliver calls that cannot be properly routed to a default PSAP. The more likely scenario is that the originating carrier has agreements with the aggregator to deliver those calls to a call center to triage the calls. Once a call gets to the selective router the 9-1-1 Authority and the selective router operator may have agreements as to how to handle calls that cannot be delivered to the Primary PSAP. There may be a default PSAP assigned and the selective router may use the ingress trunk group, or other means, to route the call to the default PSAP.

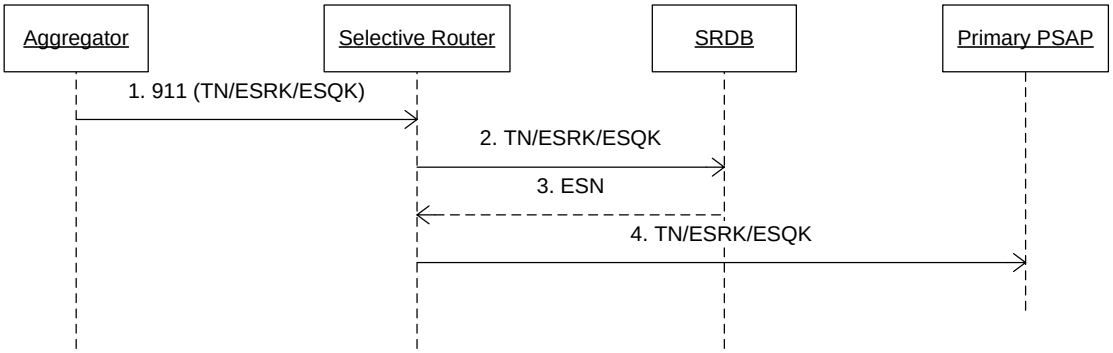


Carrier / Aggregator Combining Traffic Over a Common Trunk Group to a Selective Router

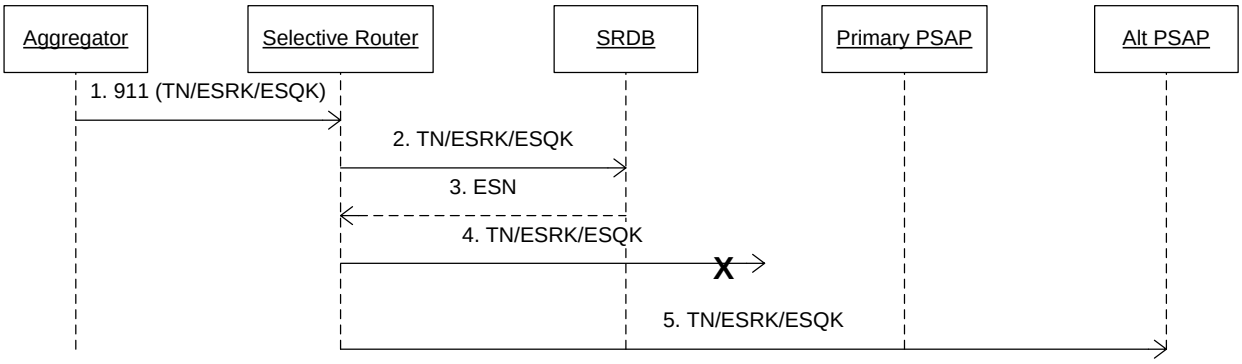
3.2 Normal Call Flow Scenarios Today

Today, emergency calls are predominantly selectively routed. That is, routed to the PSAP based on ANI/pANI and information in the Selective Router Database (SRDB). Further information to facilitate dispatch and call management is provided with the ALI information that is delivered to the PSAP. Selective routing of the specific call type can be performed by using different pANI ranges for different service types. If the call cannot be delivered to the Primary PSAP because all trunks are busy it may be alternate routed. If the Primary PSAP cannot be determined the selective router may route the call to a default PSAP.

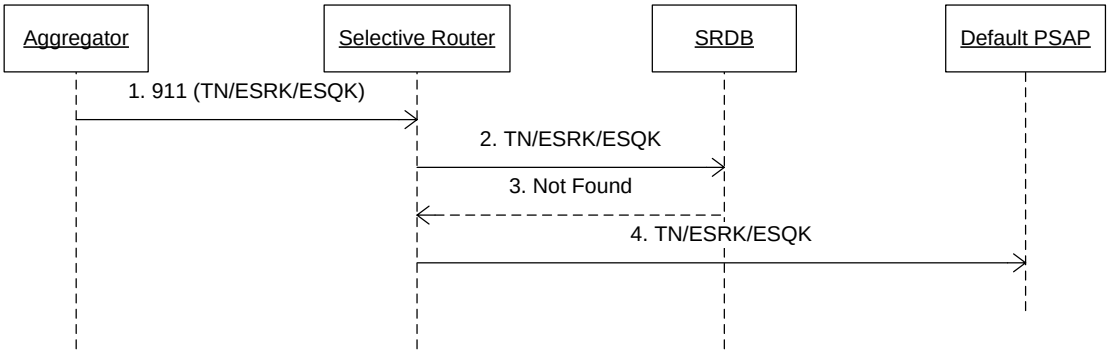
The following figure illustrates the normal call flow where the call is selectively routed and delivered to the Primary PSAP. The 9-1-1 call is routed from the aggregator (or originating carrier) to the selective router passing the ANI/pANI (TN/ESRK/ESQK) (1). The selective router queries the SRDB to obtain routing instructions (2) and the SRDB returns the ESN (3). The selective router delivers the call to the PSAP passing the ANI/pANI (TN/ESRK/ESQK) (4).



The following figure illustrates the scenario where a call cannot be delivered to the PSAP due to the fact that there are no trunks available (or other similar reasons). The 9-1-1 call is routed from the aggregator (or originating carrier) to the selective router passing the ANI/pANI (TN/ESRK/ESQK) (1). The selective router queries the SRDB to obtain routing instructions (2) and the SRDB returns the ESN (3). The selective router attempts to deliver the call to the Primary PSAP, but is unable to do so (4). The selective router determines its alternate routing strategies and delivers the call to the alternate PSAP passing the ANI/pANI (TN/ESRK/ESQK) (5).



The following figure illustrates one scenario where the selective router cannot determine the Primary PSAP and has to deliver it to a default PSAP. The 9-1-1 call is routed from the aggregator (or originating carrier) to the selective router passing the ANI/pANI (TN/ESRK/ESQK) (1). The selective router queries the SRDB to obtain routing instructions (2) and the SRDB is unable to associate the ANI/pANI (TN/ESRK/ESQK) with an ESN and return it to the selective router (3). The selective router uses default routing strategies to deliver the call to the default PSAP passing the ANI/pANI (TN/ESRK/ESQK) (4).



3.3 Impacts to Entities

3.3.1 PSAP Impact

Today, in the legacy TDM network interconnection architecture, an originating carrier typically interconnects to an E9-1-1 service provider's selective router using a trunk group that only carries calls associated with one service type (i.e. wireline, wireless, or VoIP). In the E9-1-1 PSAP network today, some PSAPs may only take calls for a subset of service types. Typically, the designation of a default PSAP at the SR is determined by several factors including the service type that is carried by the trunk group into the SR. In addition, at the SR only one PSAP may be designated for default routing (i.e. missing information in the call set up message or missing SRDB entry) and a different single PSAP could be designated at the SR for overflow routing.

When shared trunk groups are deployed, the multiple service types that are carried by the trunk group must match the capabilities of the designated alternate and default PSAPs. These considerations need to be addressed during service introduction and as part of business agreements between the network entities involved. For example, some PSAPs are designated for wireless and others are designated to receive all service types. In some instances, a designated default PSAP and overflow PSAP may be the same.

When multiple types of service are combined on a common trunk group, best practices traffic engineering should be used to match trunk group assignments to expected load. Realizing that no network can be designed for the severe overload scenarios, the aggregator may utilize a congestion control methodology in cooperation with the E9-1-1 service provider and the associated PSAP. Trunks that accommodate calls from all service types should be engineered so as to not render the trunk inaccessible to subsequent calls originating from other service types. In addition, PSAPs should have the ability to traffic engineer interconnection if they wish to segregate traffic types from the selective router to their PSAP. The capability and capacity of overflow routing to a default PSAP from the carrier or aggregator network may help mitigate congestion that can occur from a single event. See section 5.1 for an example of using trunk design to maintain routing in the event of overload due to a single event.

3.3.2 Originating Carrier/Aggregator Impact

Where permitted, a carrier might choose to utilize gateway architecture to combine calls from multiple service types onto a common trunk group. Thus, a carrier might have multiple sub-tending networks interconnected to the gateway where the gateway combines traffic onto the common trunk group.

When common trunk groups are deployed, in order to assist in testing and/or trouble resolution, the originating carrier/aggregator should be equipped with the capability to isolate and troubleshoot individual outages, call abandonments, nuisance calls, etc. from the different subtending networks.

Often an originating carrier/aggregator may alternate route calls if a trunk to a selective router is not available. Depending upon the carriers' implementation of common trunk groups, they may not be able to alternate route based upon originating call service type, and may only have one alternate route available for the entire common trunk group. In addition, some PSAPs also request overflow only on out-of-service conditions and not all trunks busy condition. The ability of the carrier to determine the reason for overflow and implementing it depends upon the carrier's architecture and the switching equipment that is deployed by the carrier. These alternate routing strategies need to be discussed among the business parties as the services are introduced.

The originating carrier/aggregator may have the capability to default route based upon the service type of the originating call. Some carrier equipment has this capability; or in some cases, business agreements require that these types of calls be routed to a call center for processing.

The use of an aggregator does not relieve the originating carrier of its responsibilities; however, often the aggregator manages these relationships for the originating carrier. Based on local conditions, or regulatory climate, the aggregator may need to or be expected to identify all their carriers and service types to the E9-1-1 Authority as the services are introduced.

If a common trunk group is utilized, activities associated with re-homing and re-configuration (e.g., moving from one 9-1-1 selective router to another, migrating from one switch to another, etc.), must be managed between the aggregator and the selective router provider. Waivers / releases from all impacted parties may be required when multiple service types are being carried on one common trunk group. Generally the aggregator manages these on behalf of the originating carrier.

When multiple types of service are combined on a common trunk group, the aggregator must manage their trunk selection and congestion control methodology based upon industry best practices for network engineering. For example, an event might consume all resources on a common trunk group between the originating carrier/aggregator network and the SR due to the generation of multiple calls at a single time, which could block traffic from other providers' customers from reaching the selective router. For these conditions, the aggregator may consider how to throttle or control traffic if calls from various traffic types are competing for the limited trunks that are going to the selective router over a common trunk group. The aggregator may utilize a congestion control methodology in association with the E9-1-1 service provider and the associated PSAP such that common trunks can accommodate calls from all service types, so that a single event does not render the trunk inaccessible to subsequent calls originating from other service types. The capability and

capacity of routing to a default PSAP or call center from the carriers' or aggregators' network can provide an alternate route to a PSAP in the event that calls cannot be carried on its' primary route selection. See Section 5.1 for an example on how trunk design can reduce the possibility of congestion and how trunk design can mitigate blocking from a single event consuming all available capacity.

The trunk group should be sized using sound traffic engineering principles. The designated overflow strategy may use alternate trunks to a selective router, a designated alternate PSAP or a call center that is accessible from the carrier's network and should be capable of handling traffic from all applicable traffic types.

3.3.3 Selective Router Impact

In order to effectively maintain and troubleshoot systems, a selective router operator should be able to work with the originating carrier/aggregator to trouble shoot problems and to easily identify and isolate network issues. Utilizing a common trunk group means that the selective router operator must work with the originating carrier/aggregator to identify network issues on trunks where multiple service types are carried. For example, if a selective router provider determined that they may need to take a trunk group out of service (for example, a PSAP reports that they are receiving an inordinate number of misdialed or harassing 911 calls traced to one of the service type coming in over the aggregator's trunks), it would have to work closely with the originating carrier/aggregator since doing so would impact other potential live traffic from other than the provider originating the trouble calls. Typically, trunks are not taken out of service to determine the root cause of service anomalies. If common trunks are used, it is important to note that since multiple types of calls are carried on the trunk, placing this trunk out of service will have a larger impact on the customer base that attempts to place emergency calls.

3.3.4 Business Impacts

The originating carrier or the aggregator may, in some cases, be required to understand and supply their traffic distribution (number of calls, minutes used, etc) by service type. Since a common trunk group may be used by all traffic types, simply looking at trunk utilization statistics may not provide the information that is required by the carrier or aggregator. Other logging mechanisms may be used to provide this information.

If a carrier or aggregator wishes to reconfigure their network to utilize common trunk groups, they may have termination liabilities associated with their current network configuration that economically prohibits them from re-architecting their network for maximum efficiency.

Congestion control, trouble isolation, alternate routing may be managed based upon business agreements among the originating network providers, 911 service providers and PSAPs. E9-1-1 trunk provisioning between an aggregator and a Selective Router is based upon the traffic engineering analysis among the aggregator and its originating network partners.

Grade of Service (GOS) accountability for the E9-1-1 network is the responsibility of all parties – the originating network, the transport network, the switching network, and the call receiver. In the event that a shared trunk is implemented, the carrier/aggregator holds a major stake in the

implementation since they will integrate traffic from all service types onto the common trunk and deliver it to the E9-1-1 service providers' selective router. In both common trunk implementations and dedicated service types trunks, the carrier/aggregator is responsible for the provisioning, sizing, and congestion control methodology on the TDM trunk between the carrier/aggregator network and the SR. Both the E9-1-1 service provider and the PSAP are responsible for maintaining the GOS for their portion of the network from SRs to the PSAP.

3.4 Congestion Control, Default Routing, Diversity, and Redundancy – Impacts of the use of Shared Trunk Groups.

Congestion control can be implemented using best practices network traffic engineering and recognizing responsibilities of the originating network service provider, aggregator, selective router operator, and PSAP administrator.

Default routing is different than congestion control. Default routing is an error situation and may be defined as not having the ANI (ANI failure) to route the call or not having the routing databases populated with routing information, or the originating carrier sending the call to the incorrect selective router. In today's reliable networks, ANI failure is a minimal issue (due to the use of SS7 signaling), SRDB quality is being resolved through effective database management practices, and work between providers is being done to assist in delivering calls to the proper selective router.

In the originating network, the carrier or the aggregator can provide facility diversity and redundancy to the selective router based upon sound engineering principles (i.e. diverse facilities, alternate routing to another SR, etc). If the selective router operator implements a dual tandem configuration, calls can be directed to a secondary or alternate selective router that will route the call to the PSAP. The alternate selective router must accommodate calls from the aggregator or carrier and also handle overflow and the necessary default routing.

Diversity and redundancy from the selective router to the PSAP is accommodated by the E9-1-1 service provider. Depending upon the capabilities of each PSAP regarding call processing, the network interconnection architecture between the SRs and the PSAPs, and the capabilities of the SR will determine how redundancy and diversity is implemented.

3.5 Introduction of New Services that may use Common Trunk Groups

There are emerging services that require access to emergency services, but their business cases may not support the build out of dedicated trunks to the selective router. This section provides an overview of those emerging services.

Telematics services started offering access to emergency services when the user pushed the emergency button on the car service panel. That activated a data, then voice call to the telematics service center. If the call center agent can converse with the occupant, they will ascertain the seriousness of the emergency. If first responders were needed, the call center agent would identify the appropriate PSAP and call the PSAP on its administrative line. The call center agent would give the PSAP sufficient information such that first responders could be dispatched. This is an inefficient method to dispatch emergency services since verbal communication is required to ascertain the location of the occupant. The evolution of this service is to route telematics calls as native 9-1-1 calls

and deliver the location with the ALI query. This allows the PSAP to use normal call handling and dispatch processes to address the incident. Since telematics providers offer a nationwide service it is impractical for them to build out trunks to each selective router. A cost effective procedure is to route these calls through an aggregator and have that aggregator deliver the call to the selective router across common trunks using the same mechanism as VoIP services.

Satellite carriers are also emerging and require access to emergency services. These carriers are introducing services that deploy GPS-enabled handsets that have the ability to provide the location of the caller. The first services required the user to dial 9-1-1 and those calls were routed to a call center similar to the way telematics processed the emergency call. The call agent determined the user's location and called the PSAP on its administrative line. The evolution of this service is to route satellite calls as native 9-1-1 calls and deliver the location with the ALI query. This allows the PSAP to use normal call handling and dispatch processes to address the incident. Since satellite providers offer a national/global service it is impractical for them to build out trunks to each selective router. A cost effective procedure is to route these calls to an aggregator and have that aggregator deliver the call to the selective router across common trunks using the same mechanism as VoIP services.

Another example of an emerging service is carriers that are introducing Fixed Mobile Convergence. These carriers may offer traditional wireless services and a VoIP-like service across their footprint.

If emerging services are required to continue to deliver emergency calls to the administrative number of the PSAP, then the PSAP will not be able to utilize the efficiencies that come with the use of the E9-1-1 environment to work the emergency.

The salient point to these examples is that in order to allow more users access to public safety and enhance network cost efficiencies, processes and procedures that allow call delivery over common trunk groups must be accepted by the industry and implemented.

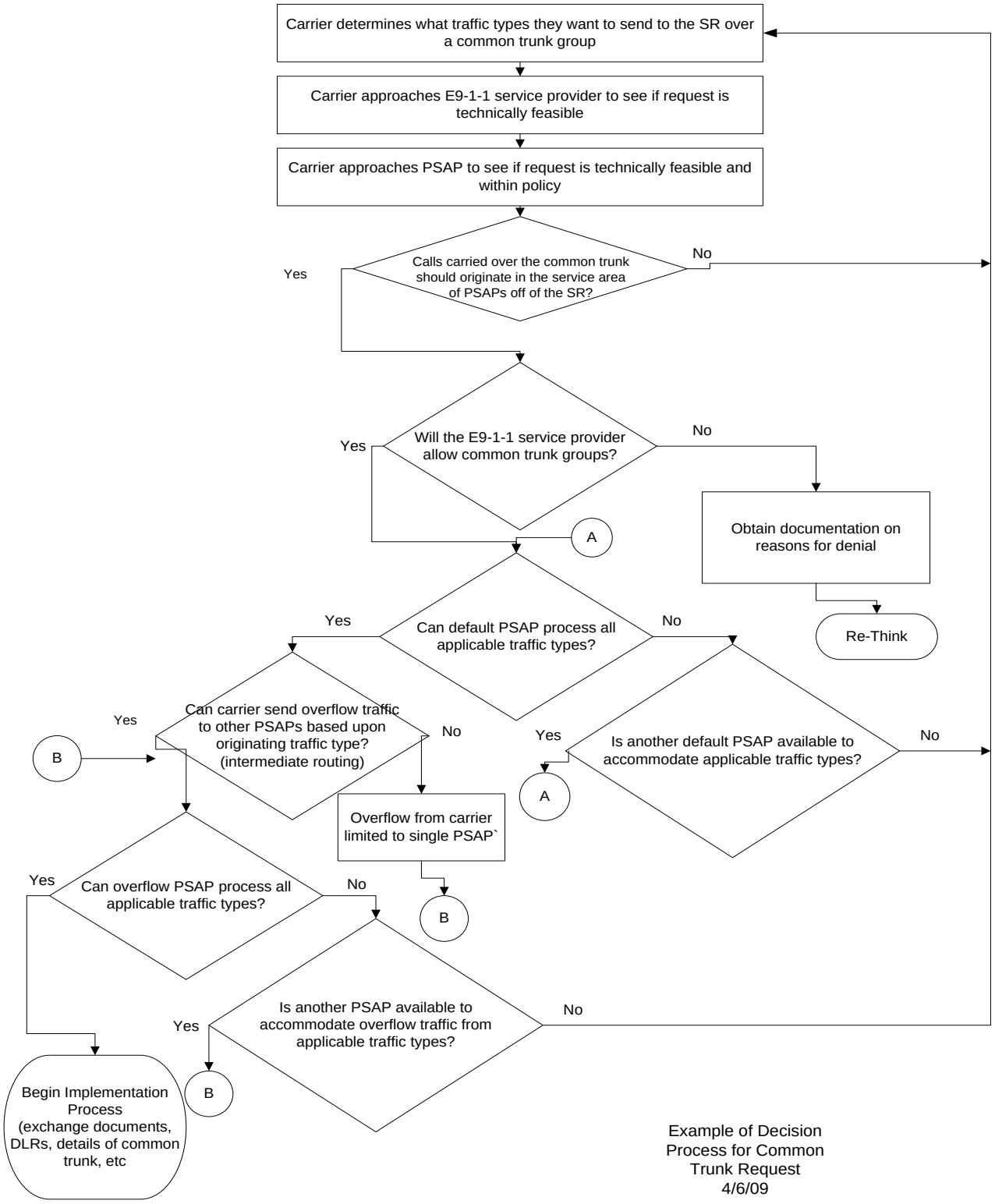
3.6 Decision Process to Address Anomalies

As discussed previously, default routing is an anomaly in call processing caused by the absence of ANI in the call flow or an error in the routing database. The following flowchart only applies for this anomaly when the PSAP requires different treatment (i.e. default routing) based upon different service types. The flowchart below represents an example of the decision process used by the parties in grouping and assessing the impact of default routing. This example considers default and overflow routing as conditions in the decision process. The decision flow and decision criteria will vary from E9-1-1 service provider to provider as well as locale to locale. This example shows what may be considered in honoring the request.

The analysis of the utilization of a shared trunk group for a carrier may be based upon:

a. Capabilities and policy at the PSAP level
b. Capabilities and policy at the E9-1-1 service provider level
c. Feedback from the 911 Authority
d. Hardware and default routing capabilities of the SR
e. Hardware and routing capabilities of the carriers' switching equipment
f. Capabilities of the Default PSAP

g. Capabilities of the Overflow PSAP
   i. In the case of default and overflow PSAPs, alternate overflow or default PSAPs may be selected to accommodate the use of common trunk groups



Example of Decision Process for Common Trunk Request
4/6/09

4 Recommended Reading and References

NENA Master Glossary of 9-1-1 Terminology

NENA Standard 03-006 titled "NENA Standards for E9-1-1 Call Congestion Management"

5 Exhibits

5.1 Example of controlling overflows from carrier network to selective router over common trunk group.

This example shows how trunk groups and route selection can be used to improve the reliability of call delivery into a selective router. This may be considered a form of congestion control, although it is more appropriate to classify it as sound traffic engineering principles to mitigate call overflow when a single event from a single service type overwhelms a network.

Trunk Groups 1 and 2 originate and terminate at the same location. But they are distinct trunk groups.

Total "common" trunk size is (members of trunk 1 group) + (members of trunk group 2)

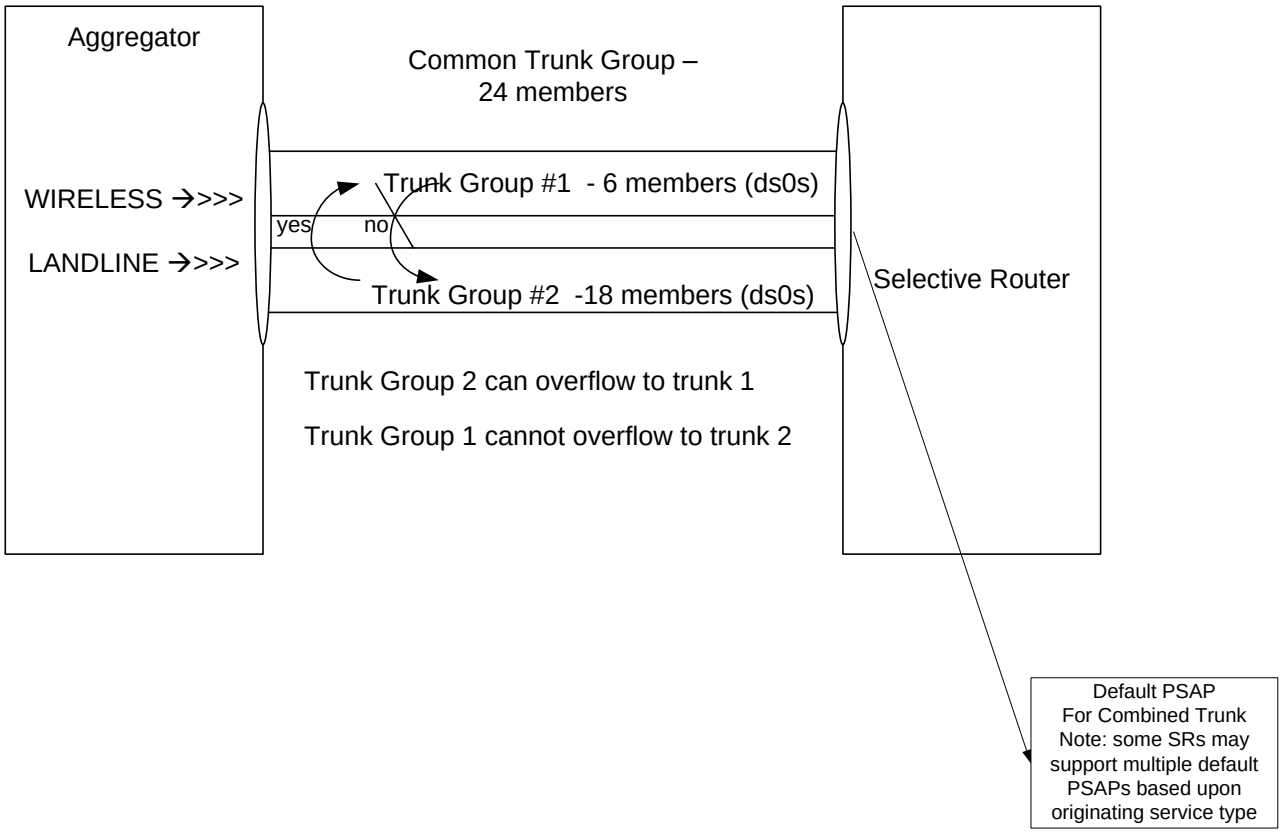
For example,

Trunk Group 2 has 18 available members
Trunk Group 1 has 6 available members
Common trunk size is 24 members

Through route selection, trunk group 2 can overflow to trunk group 1, but trunk group 1 cannot overflow to trunk group 2.

Type of service routing segments traffic as follows:
Wireline originations point to trunk 2
Wireless originations point to trunk 1

Trunk group 1 is sized for busy hour load of wireless (or largest user based upon call attempts per second)



If there is a highway emergency, trunk group 1 of the common trunk group may become congested and may not accept additional mobile calls. But trunk group 2 still has capacity to accept new originations from the aggregator from their wireline (non mobile) customers.

In the event of a wireline emergency, all 24 members would be used by wireline originations.