Before The
Federal Communications Commission
Washington, DC 20554

In the Matters of	**)**	
	)	
Location-Based Routing for	**)**	**PS Docket No. 18-64**
Wireless 911 Calls	**)**	
	)	

REPLY COMMENTS OF

COMTECH TELECOMMUNICATIONS CORP.

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Introduction

Comtech Telecommunications, Inc. ("Comtech")[1] hereby submits its reply comments in response to the Notice of Inquiry ("NOI" or "Notice") released by the Federal Communications Commission ("Commission" or "FCC") in this docket[2]. Comtech offers the following for the Commission's review.

A. Magnitude of Phase 1 Routing Problem is Unclear

While commenters cited examples of unwanted Phase 1 Public Safety Answering Point ("PSAP") routing issues, and several included small studies, the true nature and extent of this issue nationally is unquantified, and even the definition of what constitutes a so-called "misroute" among commenters is not standard. One filing noted that 13% of emergency calls were "misroutes". Other comments were based on only two sets of trial data from CA and WA that showed up to 38% misrouted calls in one of those sampled areas. Other comments stated that this non-optimal routing occurs to varying degrees, depending on the geographic area, demographic density, and jurisdictional layout in conjunction with cell tower coverage. In summary, national statistics are not available.

For simplicity, to help position 9-1-1 cell sector misroutes relative to the many other demands on Public Safety today, and to further productive discussion on this topic, Comtech suggests a "national sector metric" based on the network architecture of macro cell sites, specifically cell site sectors. Appendix A depicts a simple model for estimating the overall

[1] 1 On February 23, 2016 Comtech Telecommunications Corp. (symbol CMTL) purchased 100% of the stock of TeleCommunication Systems, Inc. ("TCS) (symbol TSYS). When referencing Comtech, we also include the historic filings and positions of TCS.
[2] *Location-Based Routing For Wireless 911 Calls* (PS Docket No. 18-64) (FCC-CIRC1803-03) (Released March 1, 2018) ("NOI" or "Notice").

percentage of sectors that could affect unwanted routing based on border criteria alone.[3] This model concludes that the ratio of sectors subject to "misroutes" from cross-sector boundaries and RF signal overreach account for less than one in ten sectors. Therefore, if the model is reasonable, it would suggest that approximately 90% of the sectors are oriented away from jurisdictional borders and are generally immune to unintended routing effects based on cross-sector boundaries and RF anomalies. Of course, more systematic and statistically valid analysis is needed. Also, several commenters noted that; there are available remedies for Phase 1 routing issues that should be tried when problems are detected, 5G networks will have greater cell site density and may resolve more problems, and i3 capable 9-1-1 networks will alleviate many undesirable routing issues.

Technological developments and the introduction of i3 aside, Comtech believes it is useful to try and quantify the problem in terms of the number of cell site sectors potentially affected, and, perhaps more importantly, the estimated volume of emergency calls from these sectors that have had to be re-routed to a more appropriate PSAP. For cell site sectors that seldom (or never) result in a misrouted emergency call, 9-1-1 Location Based Routing ("9LBR") may not be an advantage, since it will almost always take additional time when compared to Phase 1 routing. Further, to institute a regulatory rule change that mandates 9LBR across every wireless coverage area, even for sectors that don't exhibit any routing problems, may introduce unexpected consequences from higher latency for all emergency calls to increased first responder delays, and ultimately impacting more callers than are helped by theoretically "fixing" the Phase

[3] This model is a theoretical exercise designed to provide a starting point for discussion. It concerns only macro cell sectors, not 9-1-1 call volume, is based on assumptions which are fully described in Appendix A, and is subject to alternative assumptions and views. It is generic, and does not accommodate every permutation and nuance in a cellular network overlay of PSAP boundaries. However, as an objective starting point, it demonstrates that the "misroute" problem can be positioned logically in ranked comparison to other public safety needs.

1 routing problem. An 9LBR introduction to 9-1-1 will require a balanced approach, carefully considering its positive and negative aspects, as with any new technology.

Despite its shortcomings, Phase 1 routing is very fast and efficient for most emergency calls. Comtech proposes that 9LBR be considered only in PSAP areas where misroutes are a known significant quantifiable problem, or where highly accurate location is already provided with wireless emergency calls. Leaving Phase 1 call routing enabled for sectors that are not subject to cross boundary sector conditions or RF overreach, or when device location is unavailable, is sound policy.

We recognize that sectors where misroutes occur may be fewer than commonly thought, given the sheer number of sectors along PSAP boundaries in unpopulated areas. This assumes that the number of sectors subject to unwanted routing is small compared to the overall number of sectors for which Phase 1 routing would likely yield an expected result. The following graphic attempts to show this relationship.

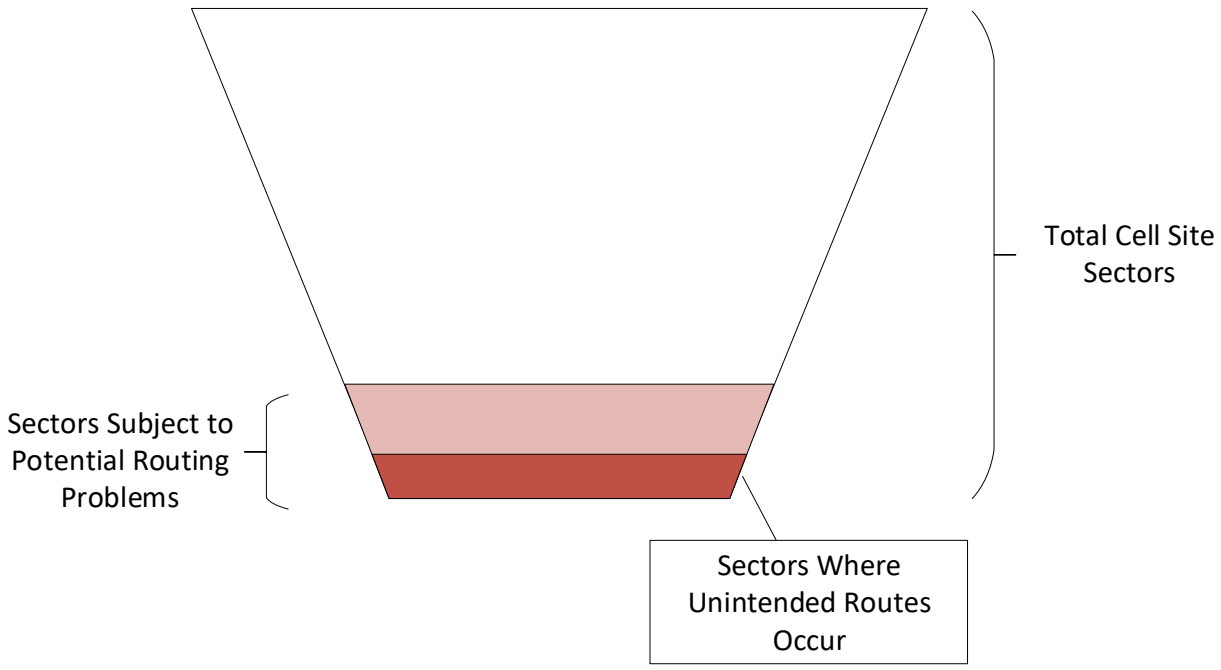

Figure A. Example Showing Relative Ratio of Sectors that Affect Routing

B. Standards-Based Approach to DBH Location Use is Needed Regardless of its Impact on 9LBR

No matter how accurate Device Based Hybrid ("DBH") location may be, 9LBR using DBH, or any more precise location technology, requires that the location information be provided quickly to the correct wireless network elements to perform the routing operation. The notion that DBH location can be provided quickly enough for this must be validated.

Integrating DBH location into the existing wireless carrier 9-1-1 call flow is a more manageable, ubiquitous, and consistent approach than providing it in its own parallel path to the PSAP. The industry's official standards development process (e.g., ATIS) should resolve this conflict to guide a reasonable and incremental approach to using DBH location before it can be used for 9LBR.

It is also important to consider whether DBH location should be in addition to carrier provided Phase 2 location or in lieu of Phase 2 location (when both are available). Most comments on this topic suggest that DBH location should be managed by the wireless carriers from within their networks in concert with their deployed handsets running approved Operating System ("OS") software and coordinated OEM configuration within the calling handset.

C. Managing Delay for 9-1-1 Location Based Routing Data Acquisition

To offer DBH location with the intent of getting an accurate location in time to perform 9LBR presents the dual difficulties of; 1) allowing DBH sufficient time to "find" the caller, and 2) what to do if location data is not available in time, is clearly erroneous (e.g., software or other error), or not available at all. Delaying the emergency call *after* the caller presses "SEND" to initiate the emergency call was generally discouraged by most commenters. In the alternative, Comtech suggests that the FCC consider allowing a test to determine the effectiveness of a modest delay *ahead* of call signaling being sent, based on handset and OS configuration.

In conjunction with processing location ahead of the call, enabling smartphones with a modified OEM dialer that displays a map during or after initial dialing of 9-1-1, consistent with the experience that many location-based apps already present today. This allows the user to visualize the network "finding them" for the necessary 2 or 3 seconds that are needed for a DBH location to be acquired. Once a location is acquired, call signaling will proceed with call routing based on whatever location information is available. Location information can then be used for routing the call, and delivered toward the PSAP over the existing network paths as it is done today for Phase 2 location.

This new proposed calling paradigm incorporating an initial mapping interface built into the regular 9-1-1 dialer interface provides parity with how many smartphone applications already function, and can be optimized in ways such as; providing the user a feature to instantly "bypass location" effectively opting out of the 2-3 second mapping process and sending the call directly to 9-1-1 via Phase 1 as is the current practice. This approach also allows the handset to predict the viability of getting a calculated location fix ahead of the call based on the environment (e.g., whether Wi-Fi beacons are visible), and allows user control over how and when callers want to use this type of interactive mapping interface when initiating 9-1-1 calls.

As noted in our initial comments, whenever used, DBH-based 9LBR should always be compared to the coarse location information derived by the other routing elements in the network. A reliable Phase 1 routing context should provide a baseline for all emergency calls to determine the cases where DBH location information does not accurately reflect the device's actual position based on proximity to Phase 1, or when DBH location is not available or not available in the timeframe needed to perform location based routing. Providing both coarse location and a more precise position information for the same emergency call elevates the level of trust for the location information provided.

D. Regulatory Status Requires Clarification

Comtech offers emergency routing and location services to carriers and to Public Safety ESInets using industry best practices and a deep understanding gained through almost 25-years of experience offering highly available systems and services. Such reliability doesn't come easily, nor can it be replicated overnight. Many new location and/or software vendors who volunteer or commercially provide "public safety grade" location data and related services directly to PSAPs appear to assume that they are not under any regulatory oversight. In Comtech's opinion, they are. The Commission should clarify this question before there is a performance or accuracy issue that results in a loss, as unregulated providers would not share relevant public safety indemnifications and could be liable for direct causation.

Conclusion

It is imperative that for 9-1-1, we use only consistent and reliable methods and solutions. DBH has great promise, is worthy of further study and experimentation, and may provide a foundation for 9LBR. However, the quest for 9LBR cannot impede the goal of maintaining reliable wireless 9-1-1 calling, and should not deter Public Safety from the immediate and greater goal of NG9-1-1 and i3 deployment.

Filed: June 28, 2018

Respectfully submitted,

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APPENDIX A.

The following model seeks to characterize the average percentage of cell site sectors that may be subject to unwanted routing based on RF signal overreach where an emergency caller's request is routed to a PSAP covering an adjacent cell sector instead of being routed to the PSAP assigned to the cell sector where the caller is located. The model uses assumptions for PSAP area shape and size, as well as projected sizes for cell towers and sectors. We start by introducing the type of cell site as a typical tri-sectored site, divided into 3 equal pie-arc polygons with sweeps of 120 degrees each.

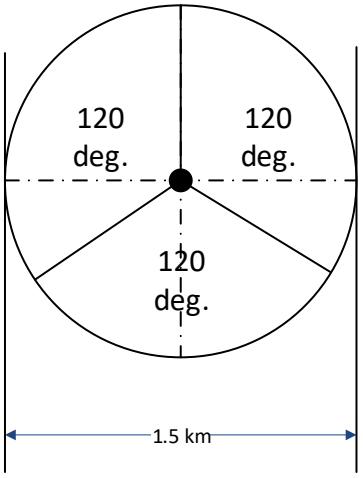

Figure 1. Example Tri-Sectored Cell Site (apertures = 120 degrees)

The model shows cell sites assembled into individual clusters of six sites each for convenience. Each cluster measures 4.5 km, or about 2.8 miles in diameter.

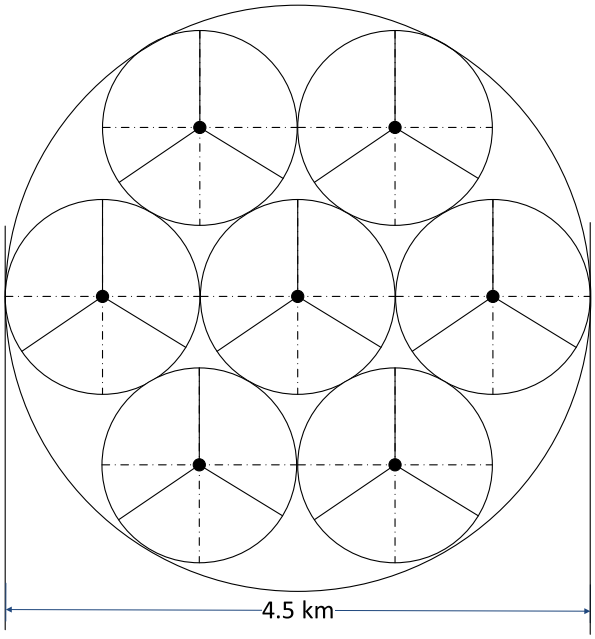

Figure 2. Cluster of Six Tri-Sectored Cell Sites

Next, clusters are assembled into a rectangular footprint with 10 clusters on each side to form a square area of 100 clusters, or 600 cell sites. Using these example numbers, there are 1800 sectors represented in an area that spans approximately 28 miles on each side, or 784 square miles total.

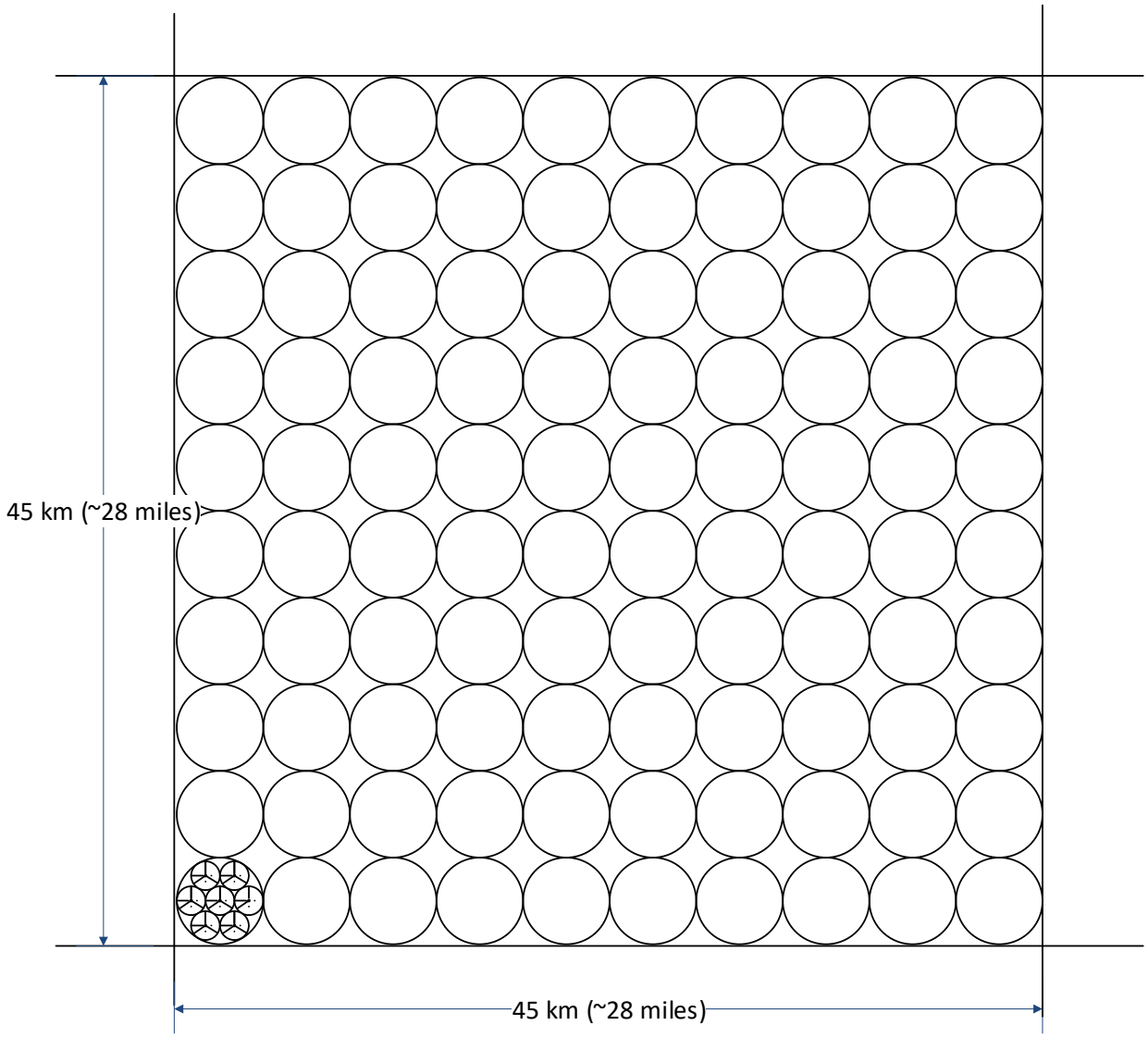

Figure 3. Example PSAP square geographic footprint

For simplicity, the model disregards actual geographic boundary variances and discontinuities such as curves, etc. The model asserts that such changes in the boundaries are generally smoothed when viewed up close, for example, such as the line representing the boundary between any two adjacent cell sites.

The number of sectors within a single cluster of sites is represented by those sites (colored and patterned) that may "bleed" radio signals over any arbitrary line drawn through the cluster. The following diagram shows the resulting effect. A caller making an emergency 9-1-1 call standing in PSAP A's jurisdiction might get picked up by a cell site tower sector that is

specified to route all emergency calls to PSAP B due to the physical realities of boundary lines that divide sectors or because of RF signal overreach.

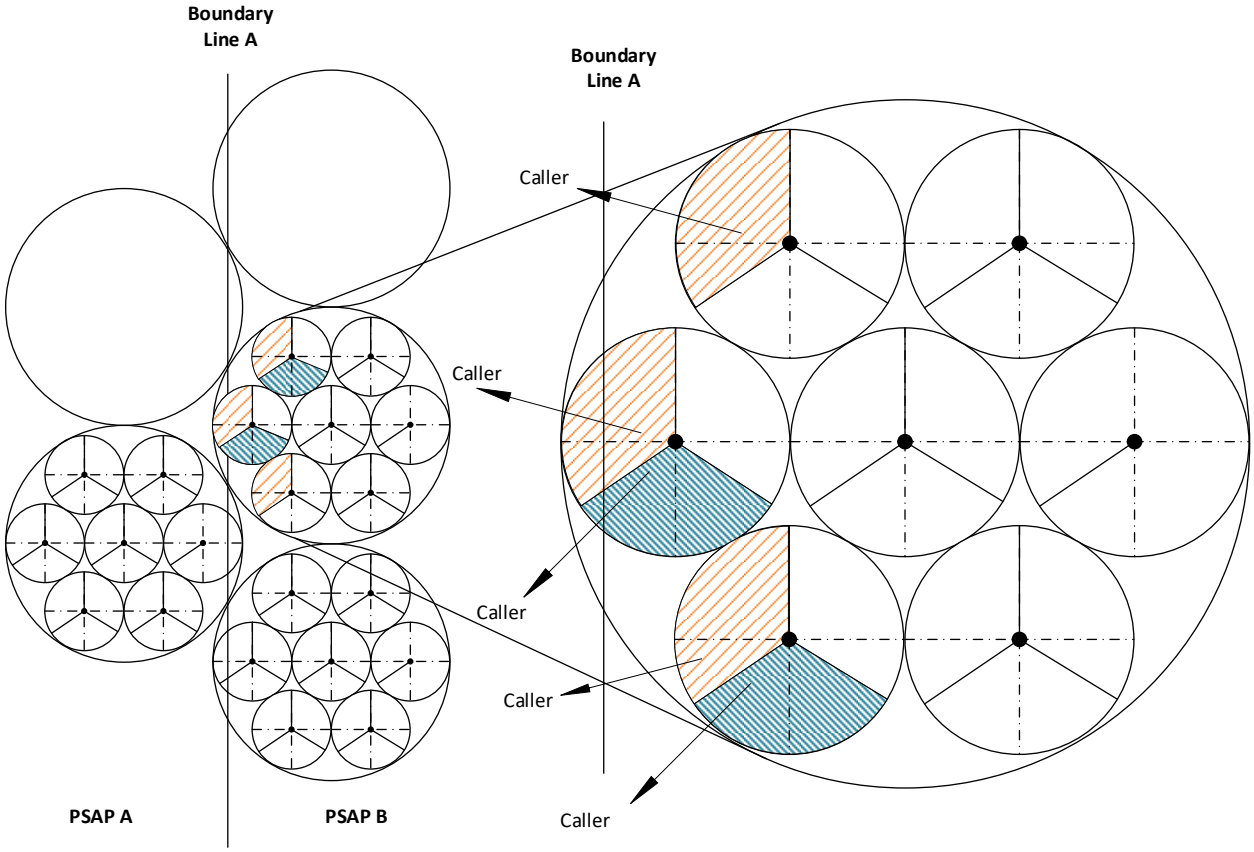

Figure 4. Sectors that may be subject to adverse call routing of 9-1-1 calls based on boundaries dividing sectors or RF overreach

Note in Fig. 4 that the neighboring clusters belonging to a different PSAP are shown wedged between adjacent opposite sectors. In practice, radio frequency separation is not exact as shown, since the sector pie arc shapes of RF signal coverage are subject to impediments, gaps, and overlaps.

The next figure shows two sides of the example PSAP area with each individual cluster having five (5) potentially affected sectors according to the model (note: six (6) sectors on the corner cluster). Again, better field analysis from actual call data is warranted.

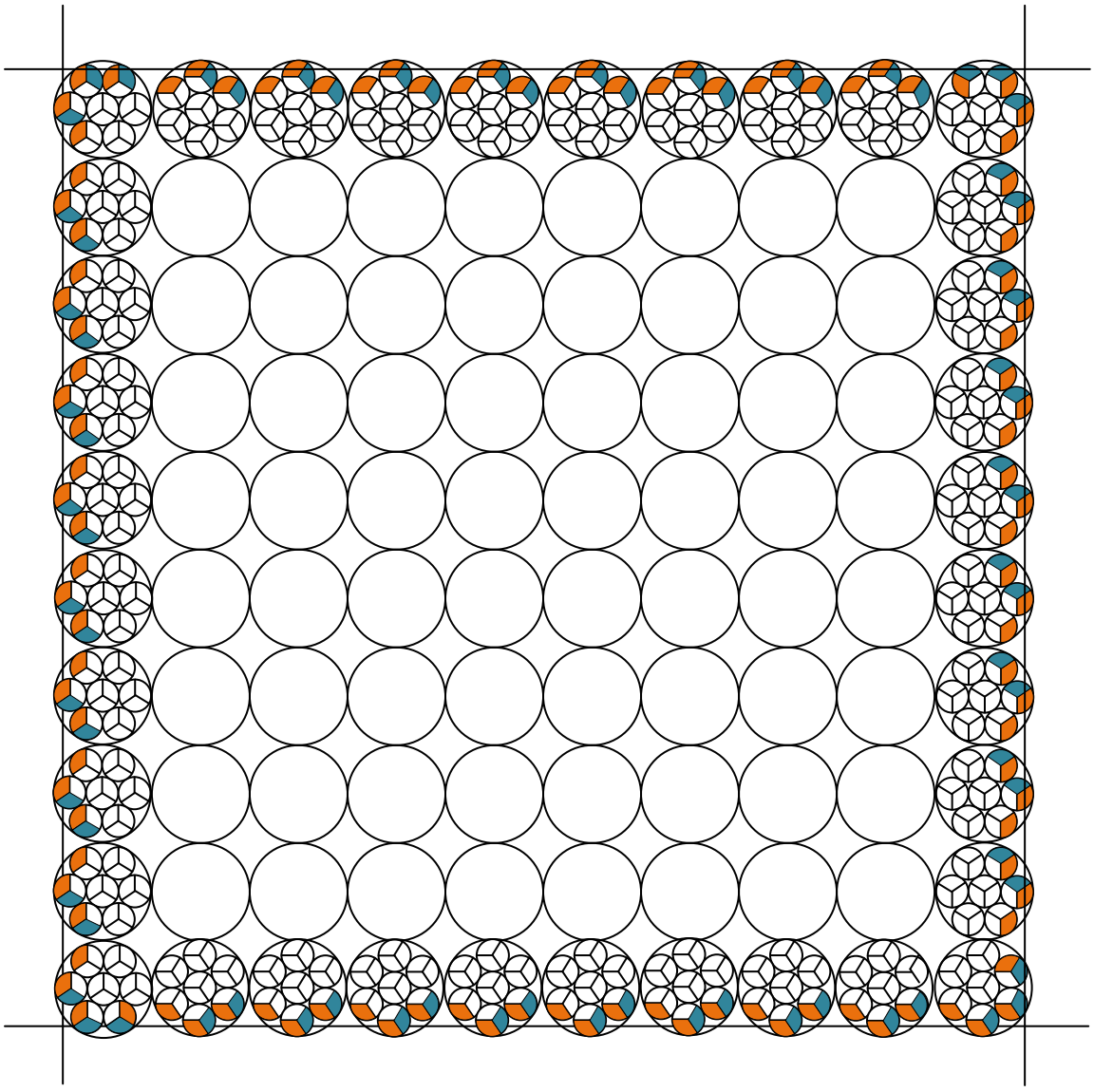

Figure 5. View of potentially affected sectors on four sides of an example PSAP geographical area where at least five (5) sectors predicted from each cell site cluster might be subject to cross-sector jurisdictional boundaries or RF overreach, potentially resulting in the emergency calls being picked up and routed to a different PSAP beyond the jurisdictional boundary.

The total number of cell site sectors presented in the above model is based on:

- Number of cell site clusters within a modeled PSAP area, 10 cell site clusters on each side of the sample (square shaped) PSAP area = 100 clusters
- 7 cell sites within each cluster
- 3 sectors within each cell site

Total cell site sectors is the result of multiplying the above, (3 x 7 x 100) = 2100 sectors total.

The model generally depicts five (5) sectors from each cluster due to outward facing orientation for each of the individual clusters along a PSAP boundary. It is possible that each of these sectors may adversely affect cell site based routing based on cross boundary sector coverage or RF overreach. Accounting for a few additional sectors at each corner, we calculate the number of the affected sectors in the model from the following calculation:

[5 x 9 x 4 (sides)] + 8 (corner sectors) = 188 sectors that may affect routing adversely

The ratio of affecting sectors divided by the total number of sectors in the PSAP area gives us the percentage of potential sectors for a given PSAP area that are likely to result in unwanted routing for 9-1-1 calls.

Percentage of sectors likely to affect routing = 188/2100 [x 100] = 0.089, or approx. 9%.