

INCIDENT COMMAND SYSTEM

CAD-to-CAD Typing System
Operational System Description
ICS 174

October 2026

This document contains information relative to the Multi-Agency Coordination System (MACS) and the Incident Command System (ICS), developed by FIRESCOPE and adopted as the framework of the National Incident Management System (NIMS). ICS products are designed to be compatible with and compliant with NIMS, as directed by the National Response Framework and adopted by the FIRESCOPE Board of Directors.

Additional information and documentation can be obtained from the following source:

FIRESCOPE
Document Control
23300 Castle Street
Riverside, CA 92518
(951) 782-4174
www.firescope.caloes.ca.gov

Table of Contents

INTRODUCTION **1**

CAD-TO-CAD TYPING SYSTEM **2**

CAD-to-CAD Tier Overview 4

Figure Legend 5

Tier 1: Informational Point-to-Point CAD-to-CAD 6

Examples ***6***

Specifics ***7***

Fire Chief Level Benefits: ***7***

Minimum Requirements: ***7***

Agreements to Consider: ***7***

Data Standards: ***8***

CAD System Minimum Requirements: ***8***

CAD-to-CAD System Minimum Requirements: ***9***

Complexity ***9***

Tier 2: Sharing Point-to-Point CAD-to-CAD 11

Examples ***11***

Specifics ***12***

Fire Chief Level Benefits: ***12***

Minimum Requirements: ***12***

Agreements to Consider: ***12***

CAD System Minimum Requirements: ***12***

CAD-to-CAD System Minimum Requirements: ***13***

Tier 3: Hub CAD-to-CAD 14

Examples ***15***

Specifics ***15***

Fire Chief Level Benefits: ***15***

Minimum Requirements: ***15***

CAD-to-CAD System Minimum Requirements: ***16***

Tier 4: Open Hub CAD-to-CAD 17

Examples ***18***

Specifics ***18***

Fire Chief Level Benefits: ***18***

Minimum Requirements: ***18***

CAD System Minimum Requirements: ***19***

CAD-to-CAD System Minimum Requirements: ***19***

Future Tiers 19

FISCAL IMPACT **20**

NEXT STEPS FOR AGENCY CONSIDERATION **20**

TYPING SYSTEM IMPLEMENTATION PLAN **21**

CONCLUSION **21**

ATTACHMENT 1: GLOSSARY OF TERMS **22**

ATTACHMENT 2: MAPPING DETAILS **27**

Direct Mappings (Tier 1 and Tier 2) 27

Table 3 - NCFD Side Resource Name Mappings ***27***

Table 4 - SDFD Side Resource Name Mappings ***27***

Table 5 - NCFD Side Call Type Mappings ***28***

Common Code Mappings (Tier 3 and Tier 4) 28

Table 6 - SDFD Problem Nature to Common Code Mappings. ***29***

Table 7 - San Diego Common Code Mappings to Agency CADs. ***30***

Table 8 - San Diego Resource Mappings. ***31***

ATTACHMENT 3: CAD DATA FIELDS **32**

ATTACHMENT 4: MIND MAP **36**

Fire Chief Level 36

Minimum Requirement Overview 37

Agreements 38

Technical 39

Minimum Requirements 40

Full Mind Map 41

INTRODUCTION

Computer-Aided Dispatch (CAD) systems are the backbone of emergency response coordination. However, the lack of interoperability between different CAD systems across jurisdictions has led to significant challenges, including delayed emergency services, misdirected calls, and limited situational awareness. These issues hinder the ability of emergency services to provide timely and efficient responses, especially during multijurisdictional incidents. A system to connect two or more CADs, called a CAD-to-CAD system, can overcome these issues by enabling dynamic CAD information sharing features such as closest resource concept or border drop.

Note that a single company may be the vendor of both a CAD and a CAD-to-CAD system.

CAD-to-CAD systems have their own inconsistencies and incompatibilities. Organizations as diverse as the Department of Homeland Security (DHS), the National Highway Traffic Safety Administration (NHTSA)1, and Integrated Justice Information Systems (IJIS)2 have described the issue, including technical standards set by bodies like the Association of Public Safety Communications Officials (APCO)3 and the National Emergency Number Association (NENA)4.

Despite this progress, great confusion still exists amongst California fire agencies regarding the capabilities and use of CAD-to-CAD systems and compatibility between systems. This is exacerbated by sometimes conflicting or incorrect statements made by software vendors, creating market confusion. For example, a recent statewide push for a CAD-to-CAD system marketed a system that in fact cannot send any data into a CAD.

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[1]National Highway Traffic Safety Administration. (2023). Computer-Aided Dispatch Interoperability Strategies for Success. In *The National 911 Program*. https://www.911.gov/assets/NHTSA-CAD-Strategies-for-the-Future_Mar-2023_Final.pdf

[2] Integrated Justice Information Systems. (2017). IJIS Institute CAD-to-CAD Data Sharing: A Review of Recommended Standards. In *The Eastern Transportation Coalition*. https://tetcoalition.org/wp-content/uploads/2018/06/CAD-to-CAD_Data_Sharing_-_Standards_20170317. pdf

[3] Association of Public Safety Communications Officials. (n.d.). *Interoperability Standards*. APCO International. Retrieved July 1, 2025, from https://www.apcointl.org/technology/interoperability/interoperability-standards/

[4] National Emergency Number Association. (n.d.). *NENA Standards and Documents*. NENA: The 9-1-1 Association. Retrieved July 1, 2025, from https://www.nena.org/page/standards

We believe FIRESCOPE is well poised to resolve this confusion. To address these challenges, we propose a Typing System for CAD-to-CAD interoperability systems. This standard classifies CAD-to-CAD systems into four Tiers, each with defined capabilities and minimum requirements. Each Tier offers more sophisticated functionality for enhancing response coordination, reducing errors, and improving mutual aid efforts. The goal is to enhance interoperability, improve operational efficiency, and promote seamless data sharing across agencies. With clearly defined Tiers, decision makers can identify the benefits each Tier brings, and both CAD and CAD-to-CAD vendors will have to meet specific minimum requirements and capabilities to claim compatibility with a Tier.

CAD-TO-CAD TYPING SYSTEM

The FIRESCOPE CAD-to-CAD Typing System is a tiered framework that outlines four levels of interoperability. Existing FIRESCOPE typing systems increase in capabilities as their numeric designation *decreases* (i.e., a Type 1 Engine is more capable than a Type 3 Engine). However, this CAD-to-CAD Typing System describes a rapidly evolving technology, and new levels with more capabilities than today's systems are expected to be added, so unlike prior typing systems the framework must account for future additions. Therefore, in contrast this system will increase in capabilities as their numeric designation increases and will use the prefix "Tier" in place of "Type" to emphasize this difference (i.e., a Tier 3 CAD-to-CAD is more capable than a Tier 1 CAD-to-CAD).

The FIRESCOPE CAD-to-CAD Typing System is a tiered framework that outlines four Tiers ranging from basic information sharing (Tier 1) to advanced, hub-based solutions (Tier 4). Each Tier represents a progression in the capabilities of an agency's CAD system to communicate and share resources with neighboring jurisdictions.

Each Tier will cover the following major topics:

- A short description.
- A brief example.
- The "Fire Chief" level summary of the use / benefits.
- A concise summary of the major features.
- A list of agreements to be considered.
- Minimum Requirements on the major software systems involved:
    - A list of minimum requirements on any CAD system claiming compatibility with this FIRESCOPE Tier.
    - A list of minimum requirements for any CAD-to-CAD system claiming compatibility with this FIRESCOPE Tier.

Each Tier builds upon the capabilities of the previous one, providing agencies with clear expectations of features, operational improvements, and technical minimum requirements. (ex: A Tier 3 CAD-to-CAD contains all the functionality of a Tier 2 and Tier 1)
For this reason, the Tiers will not include definitions included in the previous Tier, and will be introduced from least to most capable, as demonstrated in Table 1.
Due to rapidly evolving technology standards, this proposed typing system intentionally avoids specific technical details (such as should data be formatted in XML vs JSON), focusing instead on interoperability, capabilities, and framework.
Applicable standards include APCO NENA NG9-1-1 Emergency Incident Data Document (EIDD)[5] and the National Information Exchange Model (NIEM)[6].

[5] Association of Public Safety Communications Officials. (2017). *APCO NENA 2.105.1-2017 NG9-1-1 Emergency Incident Data Document (EIDD)*. APCO International. Retrieved July 1, 2025, from https://www.apcointl.org/~documents/standard/21051-2017-eidd

[6] *National Information Exchange Model*. (n.d.). NIEM Open. Retrieved July 1, 2025, from https://www.niem.gov/about-niem/niem-model

CAD-to-CAD Tier Overview

Table 1: Summarizing the minimum requirements of the FIRESCOPE CAD-to-CAD Tiers

Minimum Requirements	Tier 1 Informational Point to Point	Tier 2 Sharing Point to Point	Tier 3 Hub	Tier 4 Open Hub
One-Way	X	X	X	X
Bi-directional	X	X	X	X
Near Real-Time	X	X	X	X
Real-Time				X
Information Sharing	X	X	X	X
Connect 2 CADs	X	X	X	X
Connect any # CADs			X	X
Viewable Inside CAD	X	X	X	X
Viewable Outside CAD				X
Share Resources		X	X	X
Common Codeset			X	X
Hub processes transactions			X	X
Hub-driven Rules / Scripts				X
Open API				X
Non-CAD Integrations				X
Common Operating Picture				X

Figure Legend

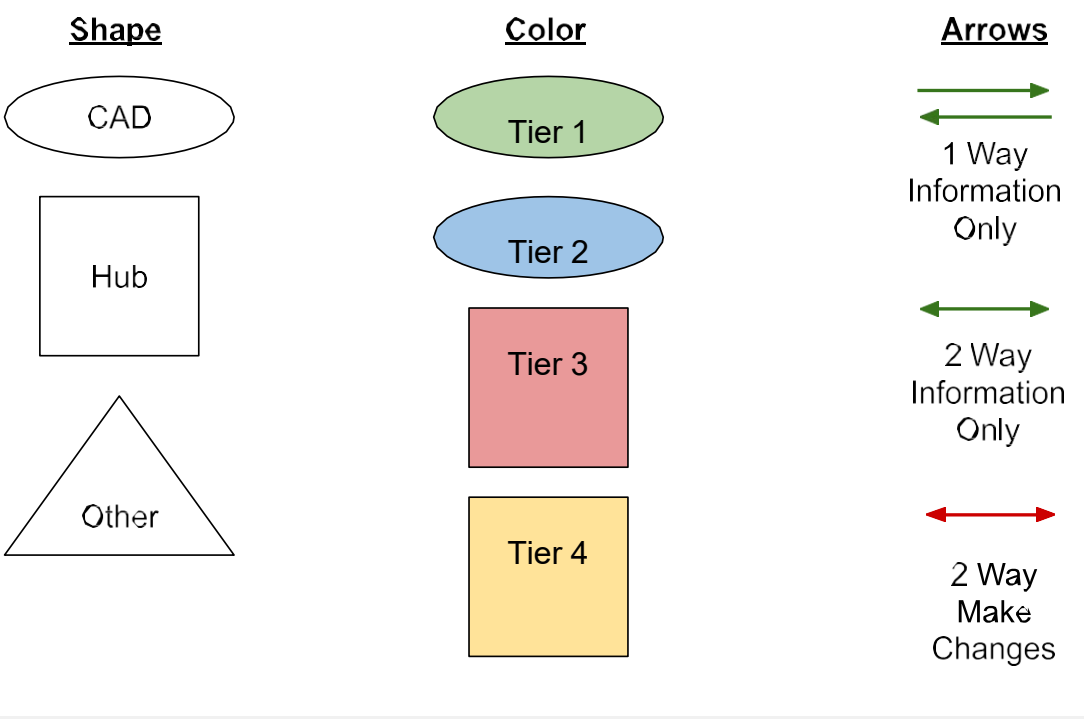


Figure 1: Legend for how figures in this document are constructed.

Throughout this document, figures will be used to show the differences between Tiers and how they may be connected. Figure 1 shows a visual legend for how these figures are all constructed. This is just a visual enhancement, the text of the document alone explains everything needed.

The nodes, or shapes, in the figure represent the systems being connected. The shape defines the type of software - CAD's are designated with a circle or oval, hubs are designated with a square or rectangle, and other external systems that are neither a CAD nor hub are designated with a triangle.

The colors of the shapes represent what CAD-to-CAD Tier is being displayed. A green background designates a Tier 1 Informational Point to Point, a blue background designates a Tier 2 Sharing Point to Point, a red background designates a Tier 3 Hub, and yellow background designates a Tier 4 Open Hub.

Lines with an arrow on a single side represent one-way sharing in that direction. Lines with an arrow on both sides represent two-way sharing in both directions. Green lines show this sharing is informational only, where red arrows show that information is being modified or resources shared.

Tier 1: Informational Point-to-Point CAD-to-CAD

At its most basic, a Tier 1 CAD-to-CAD is a direct connection between exactly 2 CAD systems to each other. This connection is used to share information only (for example, call details, resource location or status, etc.).



Figure 2: Simple Tier 1 CAD-to-CAD between two agencies.

In addition to the connection, a method for mapping the different way data is stored between different CADs is necessary. For further details, see Attachment 2 - Mapping Details and Attachment 3 - CAD Data Fields.

Examples

Example 1: Primary PSAP takes all 911 calls for their region, incident details are transferred via Tier 1 CAD-to-CAD to the responsible agency.
Example 2: Fire Agency 1 shares all their incidents (and comments, AVL, status, etc.) that have an ambulance assigned to their ambulance provider in a one way Tier 1 CAD-to-CAD.
Example 3: Agency 1 has a large structure fire near the border of Agency 2. Due to their Tier 1 CAD-to-CAD, Agency 2 can see the full details in their CAD and monitor Agency 1's resource locations and statuses.
Counterexample 1: A product that pulls information from one or more agency CADs and displays information in a separate website or application. This is often marketed as CAD-to-CAD, but under this typing system is not CAD-to-CAD, as it is not a true integration directly back to the CAD and requires monitoring of an additional external system.
Counterexample 2: A CAD offers CAD-to-CAD but cannot export the status of resources on the incident. This does not meet the minimum requirements of this typing standard which imposes a minimum set of fields to be shared.
Counterexample 3: A CAD allows an agency to create custom data fields on incidents but cannot export those fields via CAD-to-CAD. This does not meet the minimum requirements of this typing standard which requires all data fields to be exportable via CAD-to-CAD.

Specifics

Fire Chief Level Benefits:

- Simplifies communication during multijurisdictional incidents by allowing basic incident information (incident information, resource location, resource status, etc.) to be shared.
- Increased operational awareness of nearby activity.
- Increased accuracy due to direct information sharing (versus telephone/radio calls).

Minimum Requirements:

- One way or Bi-directional connection between two CAD systems.
- Near real-time (<10 seconds on average).
- Designed only for the sharing of information, such as incident information, resource location, resource status, etc.

Agreements to Consider:

- Retention Policy - how long will agencies/vendors retain each other's information?
- Visibility - Will all CAD information be shared, or only a subset (ex: certain incident types, resources, AVL, etc.)
- Security - What security minimum requirements should be placed on shared data (HIPAA, PII, CJIS, CLETS, etc.)
- Resharing - are agencies/vendors allowed to reshare the data, for example to other CAD-to-CADs, in response to legal requests, etc?
    - What happens if Agency 1 receives a Public Records Act (PRA) request for Agency 2’s data?
    - What if Agency 2 sends all its CAD data to a vendor that Agency 1 doesn’t use, and that now contains Agency 1’s data?

Data Standards:

- All information required below must be shared in common, widely used industry formats and methods, not proprietary or custom formats and methods.

CAD System Minimum Requirements:

- Access Controls
  - The ability to limit the information shared
  - For example, an agency might want to send their resource locations (AVL) to another agency only when on a shared incident.
  - For example, a law agency might not want to share their comments with non-law agencies.
- Near Real-Time update speed (<10 seconds on average)
- Import / Export
  - **At a minimum**, CAD must be able to import/export the following:
    - Incidents
    - Location
      - Address
      - City
      - Lat / Long
    - Incident # or Unique Identifier
    - Incident Type / Call Type / Problem Nature
    - Caller Information
      - Phone Number
    - Any Radio Channel Fields
    - Comments
      - Notes if present (caution notes, premise notes)
    - Response
    - Resource/Unit/Radio Name
    - Agency
    - AVL-Position
      - Lat/Long
      - Last Known position

        - Status
        - Transports
            - Destination
        - Resource Updates
            - Resource/Unit/Radio Name
            - Agency
            - Status
            - Position
    - If the CAD has **any additional incident, response, or resource data, that also must be import/exportable via CAD-to-CAD at the agency's discretion**. For examples of such information, please see Attachment 3 - CAD Data Fields.
    - All in non-proprietary common industry formats.
    - Method for mapping all fields that may differ between CADs.

CAD-to-CAD System Minimum Requirements:

- Method for mapping all fields that may differ between CADs.

Complexity

While a Tier 1 is often easiest to set up at start, this naturally introduces greater complexity if more CAD's need to be connected. Each CAD needs to develop and maintain a mapping of all data elements to each other's CAD. See Attachment 2 - Mapping Details, for further information.
If 3 agencies wanted to be connected, agency 1 would need two CAD-to-CADs to agency 2 and agency 3, agency 2 would need two CAD-to-CADs to agency 1 and agency 3, and agency 3 would need two CAD-to-CADs to agency 1 and agency 2. This complexity explodes as the number of agencies increases. Differences between these systems could cause failures.

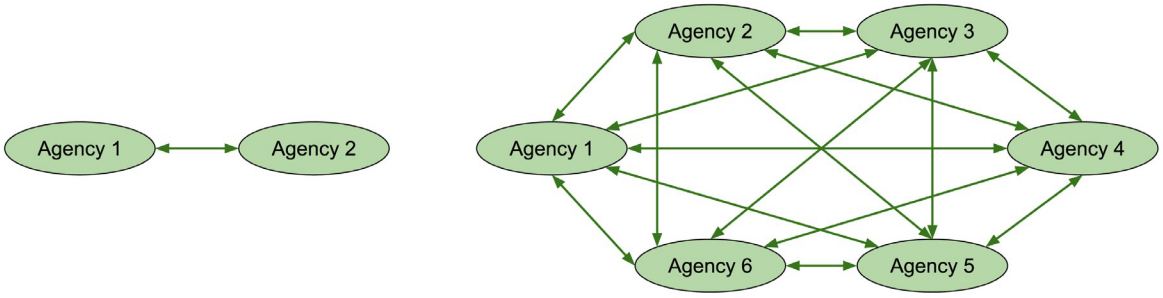


Figure 3: A simple Tier 1 CAD-to-CAD between two agencies (left) explodes in complexity when adding more agencies (right).

Figure 3 shows this issue. We can see that a Tier 1 point to point CAD is the simplest way to connect 2 CADs. In the second example, we see how complex this becomes by adding more CADs. For 6 agencies to be connected, each agency must maintain 5 mappings, with thirty (30) totally different individual mappings needed across all agencies. Adding a 7th agency would require each existing agency to develop and maintain a 6th mapping.

Tier 2: Sharing Point-to-Point CAD-to-CAD

A Tier 2 CAD-to-CAD is a simple direct connection between two CADs, but with the added functionality to not just send information between CADs, but manipulate that information, for example assigning resources, adding comments, etc.

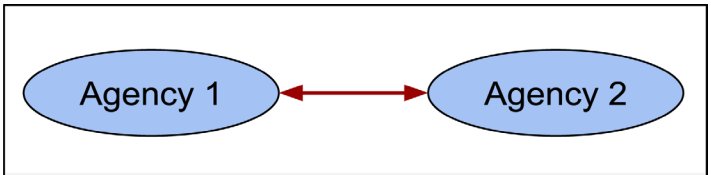


Figure 4: Simple Tier 2 CAD-to-CAD between two agencies.

Examples

Example 1: Agency 1 has a large structure fire near the border of Agency 2. Agency 1's response plan requires more resources than they have available. Using the AVL information from Agency 2, Agency 1 directly selects 2 resources from Agency 2, adds them to the call, which sends a request to Agency 2 to use those resources. If Agency 2 accepts, their resources are notified. As Agency 2 adds comments on their MDC, it appears in Agency 1's CAD for all dispatchers/resources. Agencies 1 and 2 see this all in their respective CAD in near real time.
Example 2: Agency 1 and Agency 2 share a border in a populated area. Routinely the closest resource to an incident in either agency is a mutual aid resource. Both agencies have a predetermined agreement that allows full resource sharing with no required request and acknowledgement. Using their Tier 2 CAD-to-CAD and AVL they allow automatic boundary drop of each other's resources into their jurisdictions.
Counterexample 1: A CAD offers a CAD-to-CAD with resource sharing but requires the dispatcher to manually accept resource sharing requests. This does not meet the minimum requirements of this typing standard which requires support for the configuration option to require approvals or allow direct assignment / auto grants.
Counterexample 2: A CAD offers CAD-to-CAD with resource sharing, but shared resources do not trigger all CAD interfaces such as station alerting. This does not meet the minimum requirements of this typing standard in which shared resources are to use all relevant CAD features.

Specifics

Fire Chief Level Benefits:

- Direct access to neighboring agencies' resources.
- Enables faster, more efficient, more accurate coordination of resources between neighboring jurisdictions.
- Decreased response time due to efficient, real-time mutual aid.
- Given CAD capability for automatic dispatch, mutual aid can become fully automatic aid (boundary drop).

Minimum Requirements:

- Resource sharing - ability to request and/or assign other CAD's resources.
  - When configured for requesting, Agency 1 requests the use of Agency 2's resources. Agency 2 must approve, substitute, or deny the request.
  - When configured for direct assignment, Agency 1 and Agency 2 pre-approve the use of a subset of each other's resources. Agency 1 can dispatch Agency 2's approved resources fully on their own, either manually or with automated systems (ex: boundary drop).
  - These methods can be mixed, so one set of resources can be pre-approved, a different set requires approval, a different set can be information only, and a different set hidden completely.

Agreements to Consider:

- Mutual Aid - Clearly defined rules for when dispatchers can request/grant mutual aid.
- Automatic Aid - Clearly defined rules for when the system can be configured to auto grant aid requests.

CAD System Minimum Requirements:

- Allow remote CAD's to request and/or automatically allow incident creation / resource assignment.
  - Manage a list of resources that the remote CAD is allowed to request which requires a dispatcher confirmation from the local CAD.

    - Manage a list of resources that the remote CAD is allowed to request which require no dispatcher confirmation from the local CAD and are auto granted.

- All resource evaluations, requests, assignments, and use shall be treated by both CADs as the same whether internal or external.
    - The requesting CAD, when using remote CAD resources, can use all the same features and interfaces as it can for its own resources. Including but not limited to:
        - Response Planning
        - Initial Assignment
        - Greater Alarms
        - Unit Swap
        - Automatic Dispatch
    - The granting CAD, when granting use of its local units to the remote CAD, can use all the same features and interfaces as it can for its own resources. Including but not limited to:
        - Station Alerting
        - Paging / Notifications
        - Mobiles / MDCs / MDTs
- Allow linking of separate incidents initially created individually in each CAD as a joint incident.

CAD-to-CAD System Minimum Requirements:

- Allow remote CAD's to request and/or automatically allow incident creation / resource assignment.
    - Manage a list of resources that the remote CAD is allowed to request which requires a dispatcher confirmation from the local CAD.
    - Manage a list of resources that the remote CAD is allowed to request which require no dispatcher confirmation from the local CAD and are auto granted.
- Allow linking of separate incidents initially created individually in each CAD as a joint incident.

Tier 3: Hub CAD-to-CAD

As point-to-point systems that only connect 2 CADs together, Tier 2 and Tier 1 CAD-to-CADs have an explosion of complexity as more CADs are added. Figure 5 shows this issue and how a Tier 3 CAD-to-CAD solves it:

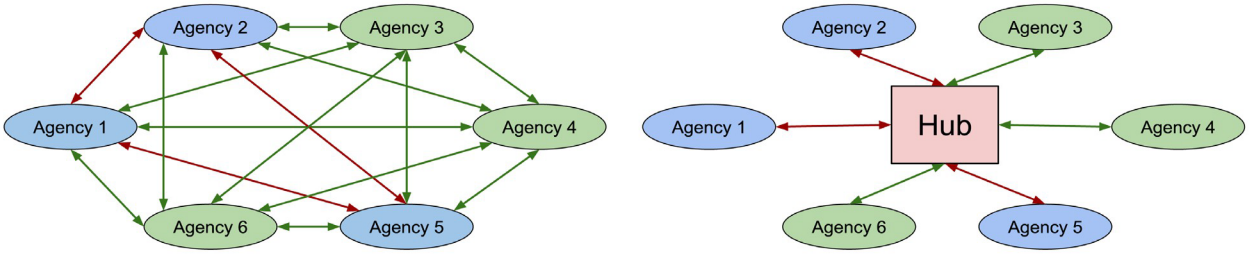


Figure 5: The complexity of a multi-agency Tier 1 and 2 CAD-to-CAD (left) disappears when using a Tier 3 Hub CAD-to-CAD (right).

In the left example, demonstrating 6 agencies with various Tier 1 and Tier 2 CAD-to-CADs, each agency must maintain 5 different configurations and mappings, each very different. If Agency 7 wants to join, Agencies 1-6 must do an all-new configuration/mapping to Agency 7, and Agency 7 must do 6 different ones.

In the right example, with a Tier 3 CAD-to-CAD, this is replaced with a hub design. In this design, each agency maintains only 1 connection and mapping to a common code format. If Agency 7 wishes to join, Agencies 1 through 6 need to do nothing (or minor tweaks to their common code mapping / sharing rules) and Agency 7 only must establish one connection and map to the common code format. For a more detailed look at mappings, and how they change when moving to a hub, see Attachment 2 - Mapping Details.

This is what a Tier 3 CAD-to-CAD is: a hub system. A hub coordinates communication between all members, and each member translates their data (problem natures, resource names, etc.) into a common code set of the hub.

As specified in this typing standard, each Tier builds on and contains the minimum requirements of the Tiers before it. It's important to note what that means for the Tier 3 CAD-to-CAD Hub is that the agencies connecting to the hub might be on different CAD-to-CAD Tiers. Figure 3 shows this, Agencies 3, 4, and 6 are only using a Tier 1 CAD-to-CAD and purely information sharing, whereas the remaining agencies are using Tier 2 resource sharing.

Examples

Example 1: All 4 fire agencies in a county are in a CAD-to-CAD hub. They can see each other's incidents, resource locations and statuses, etc. They can dispatch each other's resources as agreed to in their rule configuration. Bringing on a new agency, such as a local PD or new ambulance provider, requires only 1 new connection and mapping to the hub's common codes, with no/little changes needed by each member.
Counterexample 1: A CAD-to-CAD product advertises that it allows more than 2 CADs to connect and share resources but still requires each CAD to contain multiple individual data mappings to every other CAD in the system. This is not a true Tier 3 hub with a single set of common code maps and would still be classified as a Tier 2 system.
Counterexample 2: A CAD-to-CAD product advertises that it has a hub with a common code mapping system but requires the use of their predesignated common codes. This does not meet the minimum requirements of this typing standard which requires that the common codes be fully customizable.

Specifics

Fire Chief Level Benefits:

- Increased operational awareness for the region.
- Move from a Localized agency-to-agency coordination to a regional level coordination.
- Connect any number of communication centers, agencies, etc. Example: Fire/EMS/Law.
- Reduction in complexity for bringing on new information sharing partners such as PD/EMS.
- Each agency requires a single integration, regardless of the total number of agencies, reducing overall costs.

Minimum Requirements:

- Centralized hub system for resource sharing across multiple jurisdictions.
- Connect any number of CADs.
- Support for common code lists to normalize data across CAD systems.

CAD-to-CAD System Minimum Requirements:

- Access Controls
  - As information will now exist at the hub level, additional access control and data protection is necessary.
  - An agency may share information with the hub that they want only a subset of other agencies in the hub to see.
  - Thus, detailed ACL are needed for all data fields on which agencies in the hub are allowed to see their contents.
  - If admins can see the information in the hub itself, then those admins also must have an ACL on what they are allowed to see.
- As there is now a central hub, the resource sharing options required in Tier 2 now must be able to be configured in the central hub with varying rules to different hub members.
  - As an example, Agency 1 may want Agency 2 to be able to use their resources without dispatcher granting, whereas while Agency 3 can request them an Agency 1 dispatcher must grant approval.
- Near Real-Time update speed (<10 seconds on average)
- Import / Export
  - Everything described in Tier 1 and Tier 2.
- Mapping
  - Whereas Tier 1 and Tier 2 required field mapping between 2 CADs, at the Tier 3 hub level this requirement changes to the use of a common code system.
  - Common code sets must be able to be created and customized for mapping non-free text fields that may differ between CADs, including but not limited to:
    - Call Types / Problem Natures
    - Facilities/Stations
    - Resource/Unit Names
    - Resource/Unit Statuses
    - Destinations/Hospitals
  - It is **required** that these code sets are not fixed by the platform, but customizable by the hub members to add to, remove from, rename, and otherwise fully customize.

Tier 4: Open Hub CAD-to-CAD

The Tier 4 Open Hub CAD-to-CAD offers a wide range of integration options, due to its open API. This flexibility allows the information within the hub to be used beyond the defined CADs. The hub also features a single pane of glass view, enabling users to view region-wide incidents, resources, and more. Unlike a purely transactional Tier 3 hub, a Tier 4 open hub can incorporate advanced rules, scripts, mappings, and processing at the hub level itself.

A Tier 4 CAD-to-CAD Open Hub is not vendor specific for integration (Open API). Each agency can have their CAD (or external non-CAD) vendor write to the open specifications.

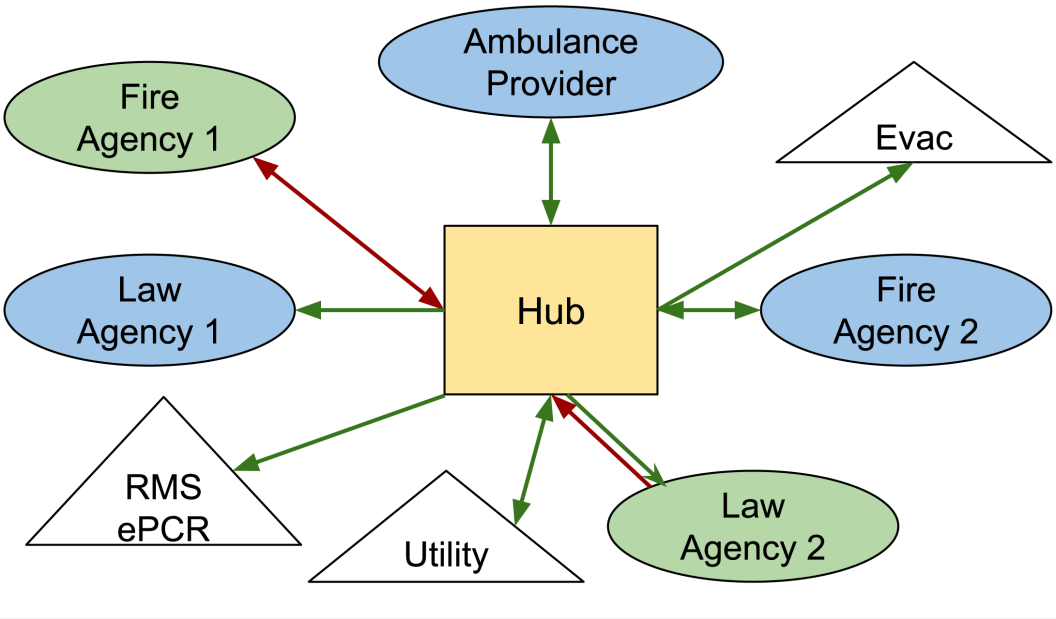


Figure 6: The flexibility and interoperability of a Tier 4 Open Hub CAD-to-CAD.

Figure 6 shows this interoperability and flexibility in action. The agencies in this hub have a mix of information flows to fit the requirements of their different scenarios.

Some information flows one way, some two ways. Some are information only, some include sharing. Some CADs connected are Tier 1, others Tier 2. Information is all present in the CADs, but also not siloed just in the CADs and flows to external partners.

Specifically, Figure 6 shows there are two fire and two law agencies in the hub. Fire Agency 2 is using a Tier 1 CAD-to-CAD, and this is sending and receiving CAD information only but not allowing any sharing or editing. Fire Agency 1 is using a Tier 2 CAD-to-CAD and is thus not only sending and receiving CAD data but has full sharing enabled. Law Agency 1 is using a Tier 1 CAD-to-CAD, and only one way, as they

receive information from the hub but do not send their CAD data back. Law Agency 2 is using a Tier 2 CAD-to-CAD, which is configured to allow them to share some other agency resources, share a subset of their information out, but not allow any sharing of their resources or changes to their data and only receives information back in. The regional ambulance provider is connected via a Tier 1 CAD-to-CAD, both receiving information they've been given permission to, while also sharing their resource locations and status to the law and fire agencies.
Furthermore, Figure 6 shows some non-CAD connections via the open API. The local gas and electric utility get a limited feed of real-time notifications into their proprietary management software on certain call types, while also being able to send messages back to the fire agencies. The county evacuation alert/mapping provider receives a one-way information only flow of certain incident information for certain call types from all agencies.

Examples

Example 1: From their office and without using CAD, a shift supervisor can see a list and map of all incidents and resource locations/statuses across all members of a Tier 4 open hub.
Example 2: A fire agency wants to notify a utility of incidents under certain circumstances without polluting their CAD with fake resources to trigger paging systems. The open hub allows notification integration into the utilities system.
Counterexample 1: A CAD-to-CAD hub that can only be integrated by contracting with the provider of the hub cannot be considered a Tier 4 open hub as a Tier 4 requires an open AI.

Specifics

Fire Chief Level Benefits:

- Have a common operating picture (COP) that improves situational awareness.
- Open integration with systems other than just CADs (utilities, evacuation systems, etc.)
- Fully real-time information sharing.
- Assist with continuity of operations between PSAPs.

Minimum Requirements:

- Fully real-time, <2 sec minimum requirements.
- An open API for easy integration, including non-CAD integrations.
- Advanced hub-side rules, filters, and scripts.

- A single common operating picture to view hub wide activity.
  - Outside of CAD
  - Configure / Manage System
  - All Incidents/Resources across all agencies

CAD System Minimum Requirements:

- Real-time import/exporting (< 2 seconds on average).

CAD-to-CAD System Minimum Requirements:

- True open API for full integrations, including non-CAD.
- Fully real-time, <2 sec minimum requirements.
- Hub side capability for
  - Rules
    - Who can see/control/interact with what
  - Scripts
    - On the fly modification of data packets
  - Filters
- In the single common operating picture view:
  - Viewable outside of CAD
  - Single map showing all:
    - All Incidents
    - All resources
- Central configuration and management by agency/user, permission based.

Future Tiers

CAD-to-CAD systems and related technology continue to evolve. Tier 4 represents the most advanced technology available today but is clearly not the end state of the technology.
Based on the shortcomings of Tier 4 CAD-to-CAD systems, the CAD-to-CAD subcommittee anticipates that likely directions for a Tier 5 CAD-to-CAD include, but are not limited to:

- Systems for connecting multiple regional CAD-to-CAD hubs together, for example into a state-wide or national hub.
- Standardizing onto a public safety grade, unified network backbone like the state ESINET.

- Support for roaming resources automatically moving between hubs based on their location.
- Connectivity from regional hubs to national ordering systems such as IRWIN.

FISCAL IMPACT

As a typing system only, adoption of this by FIRESCOPE has no fiscal impact to FIRESCOPE or fire agencies.
This system intentionally contains no pricing or cost examples for the CAD-to-CAD Tiers. The cost, even with a single Tier, can vary significantly based on the CAD's involved, the complexity and requirements of the implementation, technical considerations (e.g., on premise or cloud hosted), and licensing details (subscription or purchase and maintenance).

NEXT STEPS FOR AGENCY CONSIDERATION

CAD-to-CAD implementations are too specific to an agency's needs for a general implementation plan. The CAD-to-CAD Sub-Committee can offer some general next steps for an agency considering the implementation of FIRESCOPE Typed CAD-to-CAD system:

- Include the suggested stakeholders in a discussion of your requirements and needs to identify the Tier needed and any additions to it
  - PSAP / CAD Managers
  - Dispatch Managers / Admins / Leads
  - IT Manager
  - Operations
  - Other PSAPs to be included in the CAD-to-CAD and their stakeholders
- Work with your agency's procurement on needed contract mechanisms
  - Is a full RFP needed or can a lesser method be used?
  - Do existing CAD contracts expand or restrict the options available?
    - What if the existing CAD vendor has a CAD-to-CAD product?
- Recommended inclusions for RFP, contract, or other requirements that the selected vendor meet this Typing System for the Tier selected (plus any needed additions).
  - Review of RFPs from other agencies
  - Include and score real world product demonstrations

- Consider contract details on support methods, responsibility, and resolution periods
- Consider contract penalties for excessive system downtime or issues

TYPING SYSTEM IMPLEMENTATION PLAN

To effectively implement the CAD-to-CAD Typing System, the following steps are recommended:

1. **Approval and Adoption:**
   - Obtain approval from the FIRESCOPE Board of Directors.
   - Encourage statewide adoption among emergency service agencies and vendors.
2. **Stakeholder Engagement:**
   - Encourage collaboration between local, regional, and state agencies.
3. **Standardization Efforts:**
   - Promote the adoption of common code lists and data formats.
4. **Monitoring and Evaluation:**
   - Regularly review and update the Typing System as technology evolves.

CONCLUSION

The Typing System for CAD-to-CAD systems is a strategic initiative to enhance interoperability among emergency response agencies in California. By adopting this System, agencies can:

- Improve response times and service delivery.
- Enhance situational awareness and decision-making.
- Foster collaboration and mutual aid across jurisdictions.

This initiative represents a significant step toward a more connected and efficient emergency response infrastructure, ultimately improving public safety outcomes.

ATTACHMENT 1: GLOSSARY OF TERMS

Table 2: Glossary of Acronyms and Terms

Acronym	Term	Definition
ACL	Access Control List	Defines user and program level access.
ALS	Advanced Life Support	Definitions vary by agency, but generically Paramedic-staffed ambulance equipped for invasive interventions to treat life-threatening conditions en route.
APCO	Association of Public-Safety Communications Officials	Organization for emergency communications professionals.
API	Application Programming Interface	A set of rules allowing software applications to communicate.
AVL	Automatic Vehicle Location	Technology that tracks vehicle positions in real time.
BLS	Basic Life Support	Definitions vary by agency, but generically EMT-staffed ambulance that provides non-invasive care.
CAD	Computer-Aided Dispatch	A computer-based program used by emergency dispatchers to manage calls and coordinate resources and responses.

Acronym	Term	Definition
CAD-to-CAD	Computer-Aided Dispatch to Computer-Aided Dispatch	A system to connect two or more CADs enabling dynamic CAD sharing.
CJIS	Criminal Justice Information Services	FBI division managing criminal justice data.
CLETS	California Law Enforcement Telecommunications System	California's network for law enforcement data sharing.
	Codeset	Standard list of codes used to interpret data the same way.
COP	Common Operating Picture	A shared visual and informational platform for situational awareness.
DHS	Department of Homeland Security	U.S. Federal agency for public security.
EIDD	Emergency Incident Data Document	A standard for sharing structured incident data.
EMS	Emergency Medical Services	Medical services provided in emergency situations.
ePCR	Electronic Patient Care Report	Digital system used by EMS and Fire agencies to document patient care.

Acronym	Term	Definition
FIRESCOPE	Firefighting Resources of California Organized for Potential Emergencies	A California committee aimed at improving coordination of resources among fire protection agencies in the state.
HIPAA	Health Insurance Portability and Accountability Act	U.S. law governing medical data privacy and security.
	HUB	Device that connects computers in a network which sends data to all connected devices.
IJIS	Integrated Justice Information Systems	A nonprofit organization supporting justice and public safety information systems.
JSON	JavaScript Object Notation	JSON is an open standard file format and data interchange format that uses human-readable text to store and transmit data objects consisting of name–value pairs and arrays.
LAT	Latitude	Distance North or South of the equator
LONG	Longitude	Distance East or West of the prime meridian
MDC	Mobile Data Computer	Onboard computer system used in emergency response vehicles.
MDT	Mobile Data Terminal	Historically, an onboard data terminal for display of information in emergency response vehicles. In modern use, as a synonym for MDC.

Acronym	Term	Definition
NENA	National Emergency Number Association	Non-profit organization which develops standards for 911 systems and emergency communications.
	Near Real Time	Data processed and updated with slight delay (<10 seconds on average)
NHTSA	National Highway Traffic Safety Administration	U.S. Federal agency focused on road safety.
NG9-1-1	Next Generation 9-1-1	Modern upgrade to the legacy 911 infrastructure with internet protocol-based technology.
NIEM	National Information Exchange Model	A framework for information sharing across organizations.
PD	Police Department	Local law enforcement agency.
PII	Personally Identifiable Information	Data that can identify an individual.
PRA	Public Records Act	The California Public Records Act gives every person the right to access public records in physical custody of the Secretary of State unless the records are exempt from disclosure by law. (Government Code section 7920.000 et seq.).
PSAP	Public Safety Answering Point	The call center that answers 911 calls.
	Real Time	Data is processed immediately as it is generated.

Acronym	Term	Definition
RMS	Records Management System	Database used by public safety agencies to track and document operational records
XML	Extensible Markup Language	Extensible Markup Language is a markup language and file format for storing, transmitting, and reconstructing data. It defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

ATTACHMENT 2: MAPPING DETAILS

One of the most work intensive parts about the initial configuration and ongoing maintenance of a CAD-to-CAD system is maintaining the mappings. There are many different data elements inside each agency's CAD systems, all of which are invariably configured differently for the needs of that agency. These can be call types, common location names, resource names, etc.
Even agencies using the exact same CAD product and version may have vastly different business practices and use around data.

Direct Mappings (Tier 1 and Tier 2)

In a Tier 1 and Tier 2 CAD-to-CAD, each agency must map all these data elements for each CAD-to-CAD connection they have. As a hypothetical example, let's look at the National City Fire Department (NCFD) who wants to connect to the San Diego Fire-Rescue Department's (SDFD) CAD. Let's look at just two of these mappings. First are the resources.

Table 3 - NCFD Side Resource Name Mappings

NCFD Radio Name	SDFD Unit Name
SDE1	E1
SDE2	E2

Here we can see that while the SDFD CAD refers to these as unit names, in NCFD CAD they are called radio names. Furthermore, we see that while SDFD refers to their engines as E1, E2, etc., NCFD needs to use different names, as in NCFD's CAD E1 and E2 refer to THEIR local resources, not SDFDs.

Table 4 - SDFD Side Resource Name Mappings

NCFD Radio Name	SDFD Unit Name
E1	NCE1
E2	NCE2

SDFD meanwhile will have to maintain its own mapping of how NCFD's resource names should map into its CAD.

Table 5 - NCFD Side Call Type Mappings

NCFD Call Type	SDFD Problem Nature
Medical Aid ALS	Breathing Problems L1
Medical Aid ALS	Breathing Problems L2
Medical Aid BLS	Breathing Problems L3
Medical Aid BLS	Breathing Problems L4
Brush Fire	Vegetation - Initial Attack
Brush Fire	Vegetation 1st Alarm
Brush Fire	Vegetation 2nd Alarm

Here we can see that while the SDFD CAD refers to these as problem natures, in NCFD they are called call types. Furthermore, we see that SDFD has many more problem nature types and specificities than NCFD.
Additionally, SDFD will need to maintain their own mapping table of NCFD's call types into SDFD's problem natures (not shown with a dedicated table as it is just the inverse of Table 5 above.)
The important detail is the complexity this grows into - these are just two mapping tables of the many mappings both NCFD and SDFD will need to perform. These mappings will have to be updated and maintained as each CAD makes additions or changes in their respective CADs. For example, if SDFD adds or renames a call type, NCFD will have to immediately modify their mappings or transfers will fail.

Common Code Mappings (Tier 3 and Tier 4)

We saw in Tier 1 and Tier 2 CAD-to-CAD that the mappings of data elements between CAD's becomes increasing complex and burdensome, as each agency has to maintain a distinct set of mappings for each data elements *for each CAD in the system*, which can quickly become unmanageable.
In a Tier 3 hub system, this is alleviated using *common code mappings*. Agencies entering a hub system work together in advance of initial configuration to develop a common central set of mappings for each data element. While a CAD/CAD-to-CAD vendor may recommend starting common codes, it is a **requirement** of this typing system that these code sets are customizable (adding, removing, renaming, etc.) by each hub.

Each agency then only needs to maintain one set of mappings, regardless of the number of CADs in the hub - the mappings to the common code set.
Let's see how this affects our early hypothetical example involving the San Diego regional hub.

Table 6 - SDFD Problem Nature to Common Code Mappings.

SDFD Problem Nature	Common Code Call Type
Breathing Problems L1	BREATHING ALS
Breathing Problems L2	BREATHING ALS
Breathing Problems L3	BREATHING BLS
Breathing Problems L4	BREATHING BLS
Vegetation - Initial Attack	FIRE-VEGET
Vegetation 1st Alarm	FIRE-VEGET
Vegetation 2nd Alarm	FIRE-VEGET

SDFD maps their call types, called problem natures, into the hub's common codes for call types. This is the only mapping of call types that SDFD has to maintain - regardless of the number of CAD's in the hub. SDFD doesn't need to know about what other agencies or hub users use themselves, or how they map things. Even with the addition of a new agency to the hub, SDFD has no additional work here.
This would be repeated for every member of the hub - each would perform one mapping of their call types into the common code. For this hypothetical example, the Chula Vista Fire Department (CVFD) and NCFD would also join the hub and map their call types to the common code set.

Table 7 - San Diego Common Code Mappings to Agency CADs.

Common Code Call Type	SDFD Problem Nature	CVFD Response Type	NCFD Call Type
BREATHING ALS	Breathing Problems L1 + Breathing Problems L2	Breathing/Airway ALS	Medical Aid ALS
BREATHING BLS	Breathing Problems L3 + Breathing Problems L4	Breathing/Airway BLS	Medical Aid BLS
FIRE-VEGET	Vegetation - Initial Attack + Vegetation 1st Alarm + Vegetation 2nd Alarm	VEG FIRE	Brush Fire

This table shows that each agency that joins the hub simply maps from the common code set into their call types. Regardless of the number of agencies in the hub, or even as agencies come and go, each agency maintains just the two mappings for each data element: a map to the common code set when sending incidents, and a map from the common code set when receiving incidents.

In this hypothetical example we can see that each agency handles the call types in vastly different ways. For example, SDFD has many dedicated call types for each medical aid type, with sub types even within ALS and BLS. CVFD is simpler with just ALS and BLS types for each medical aid type. NCFD is even simpler, with just two call types for all ALS and BLS aids. The mapping system easily accommodates all this variation. Because no other member of the hub would do anything with the extra specificity SDFD uses internally, there is no need to complicate the common code set with the extra levels. Doing so would generate extra mapping work for all parties, when the business practices show no need.

Table 7 is just an example to show these mappings. No one would use a table like this, all each agency would use is what is shown in Table 6 - how they map their local data to the common code set.

As stated earlier, it is a **requirement** of this typing system that these code sets are customizable (adding, removing, renaming, etc.) by each hub. In our example San Diego Hub, there is a single common code for vegetation/brush fires called FIRE-VEGET. The point is that these common codes are living and editable. For example, in the San Diego region it may eventually be decided that one level for vegetation/brush fire is not enough for regional response planning. The region can decide to switch to VEG FIRE SMALL and VEG FIRE LARGE, and each agency simply updates its own internal mapping of its CAD to the common code.

Table 8 - San Diego Resource Mappings.

Common Code Resource Name	SDFD Unit Name	El Cajon Radio Name	NCFD Vehicle Name
SNDSNDE1	E1	SNDE1	SANE1
HTLECE1	ECE1	E1	ELCE1
SNDNCE1	NCE1	NATE1	E1

Table 8, as a final example, shows an example of how resources could be mapped among these 4 agencies. Even though “E1” means something different to each agency, and they even call their resources different labels, the common code system allows for all this to be handled. Table 8 is shown this way just for visualization, all each agency would see/maintain is the mapping from their local CAD resource name to the common resource name. They wouldn’t need to see or even care about how each other’s agency maps it.

While these examples have only shown call types and resource names, these common codes exist for all CAD data types that need to be mapped, including but not limited to call types, common locations / premises, facilities / stations, resource status, destinations / hospitals, etc.

ATTACHMENT 3: CAD DATA FIELDS

Different organizations have made attempts to capture all possible CAD data fields. The reality is, CADs are like snowflakes, and everyone is unique. This attachment is not an attempt to capture all permutations.

What is relevant to this FIRESCOPE Typing system is the following core **minimum requirements**:

1. All Tiers - A **minimum set of required fields** that must be supported.
2. All Tiers - A requirement that **all data fields in a given CAD are supported via CAD-to-CAD at the agency's discretion.**
3. Tier 3 and 2 - A requirement that all code mapping sets are **fully customizable by the agencies.**

What follows is an example list of fields from a modern CAD. This is not exhaustive, in fact, some CADs allow custom fields to be added at will. Items in this list that are required for all Tiers will be **bold**, and beyond those if a CAD had any additional data fields, for all Tiers all data fields must be supported via CAD-to-CAD.

- **Incidents**
  - **Location**
    - **Address**
    - Cross Street
    - Building
    - Apartment/Unit Number
    - City
    - County
    - State
    - Lat / Long
    - Common Name/ Premise Name
    - Grid Numbers
  - Agency
  - Jurisdiction
  - District
  - Response Area
  - Response Plan
  - Incident Type / Call Type / Problem Nature
  - EMD/EFD/EPD Determinant

- Incident Number or Unique Identifier
- Case Number(s)
- Priority (Number / Description)
- Ani/Ali Spill and any additional supplemental caller information (RapidSOS, etc.).
- **Caller Information**
  - **Phone Number**
- **Radio**
  - **Primary Channel**
  - Command Channel
  - Alt Channel
- Disposition
- Call Taker
  - Name
  - ID
  - Machine Name
- Custom Fields

- **Notes**
  - **Caution Notes**
  - **Premise Notes**
- Times
  - Phone Ring
  - Phone Pickup
  - ECT Open
  - Call Taking Complete
  - Assigned / Active
  - Call Closed
  - Sent to CAD-to-CAD
- Comments
  - **Comment**
  - Comment #
  - Timestamp
  - **Author**

- Urgent / Confidential / Category etc.

- **Response (Resources on an Incident)**
  - ALL possible resource related data and updates, including but not limited to:
    - Response #
    - Resource/Unit/Radio Name
    - Vehicle ID / #
    - Agency
    - Jurisdiction
    - Division
    - Battalion
    - Station
    - Position
      - Location Name
      - Street Address
      - Lat/Long
    - **Status**
    - Roster
    - Disposition / Cancel Reasons
    - Transports
      - **Destination**
        - Name
        - Address
        - Lat/Long
        - Apartment
        - Building
        - City
        - County
        - State
        - Zip
    - Transport Priority / Protocol

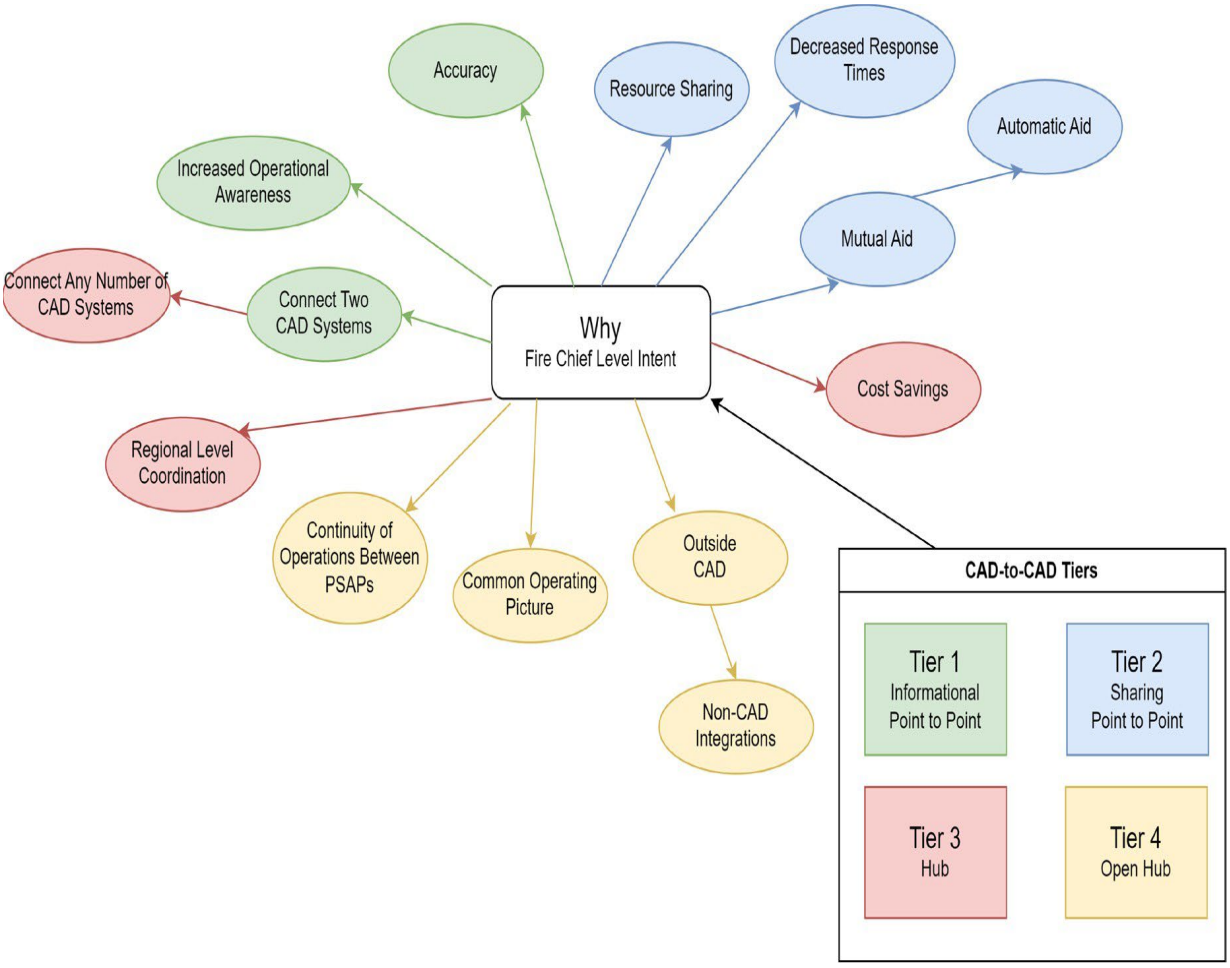
- **Resources (not on an incident)**
  - ALL possible resource related data and updates, including but not limited to:

- Response #
- Resource/Unit/Radio Name
- Vehicle ID / #
- Agency
- Jurisdiction
- Division
- Battalion
- Station
- Position
  - Location Name
  - Street Address
  - Lat/Long
- **Status**
- Roster

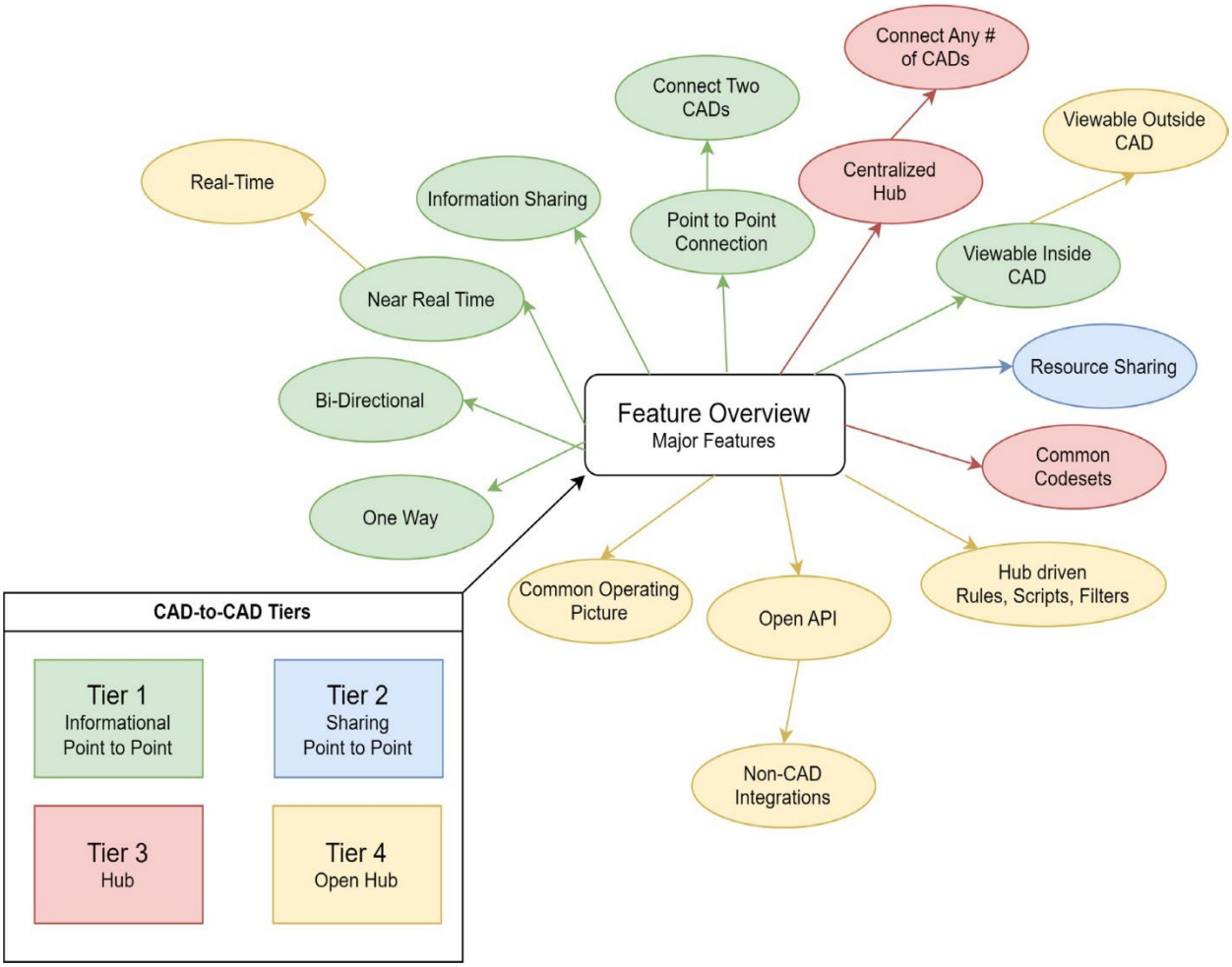
ATTACHMENT 4: MIND MAP

While constructing this system, the subcommittee used a mind map format in designing the Tiers and how they build on each other's capabilities and minimum requirements. This map is included in this attachment, starting with zoomed in snapshots of each major section for visibility.

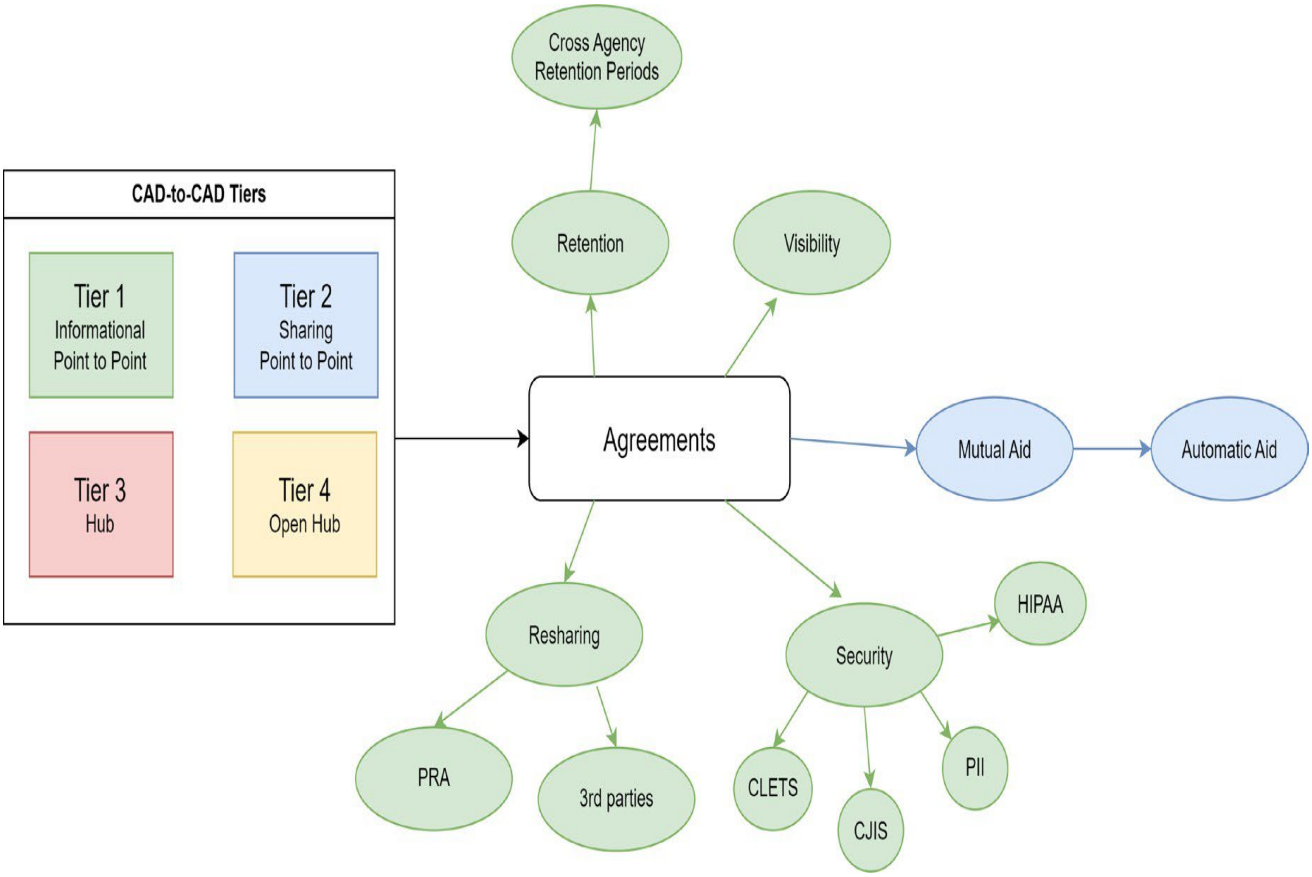
Fire Chief Level



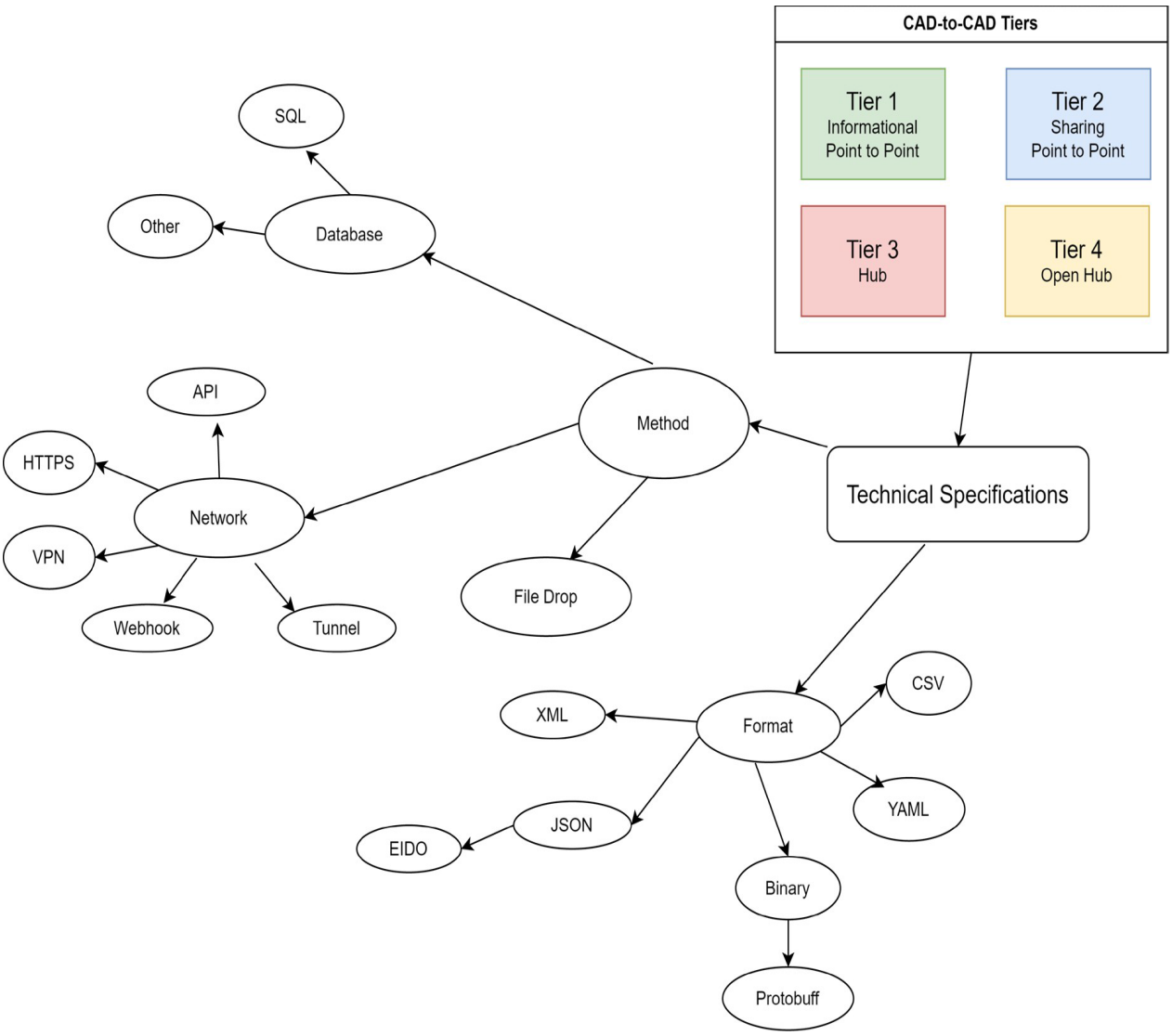
Minimum Requirement Overview



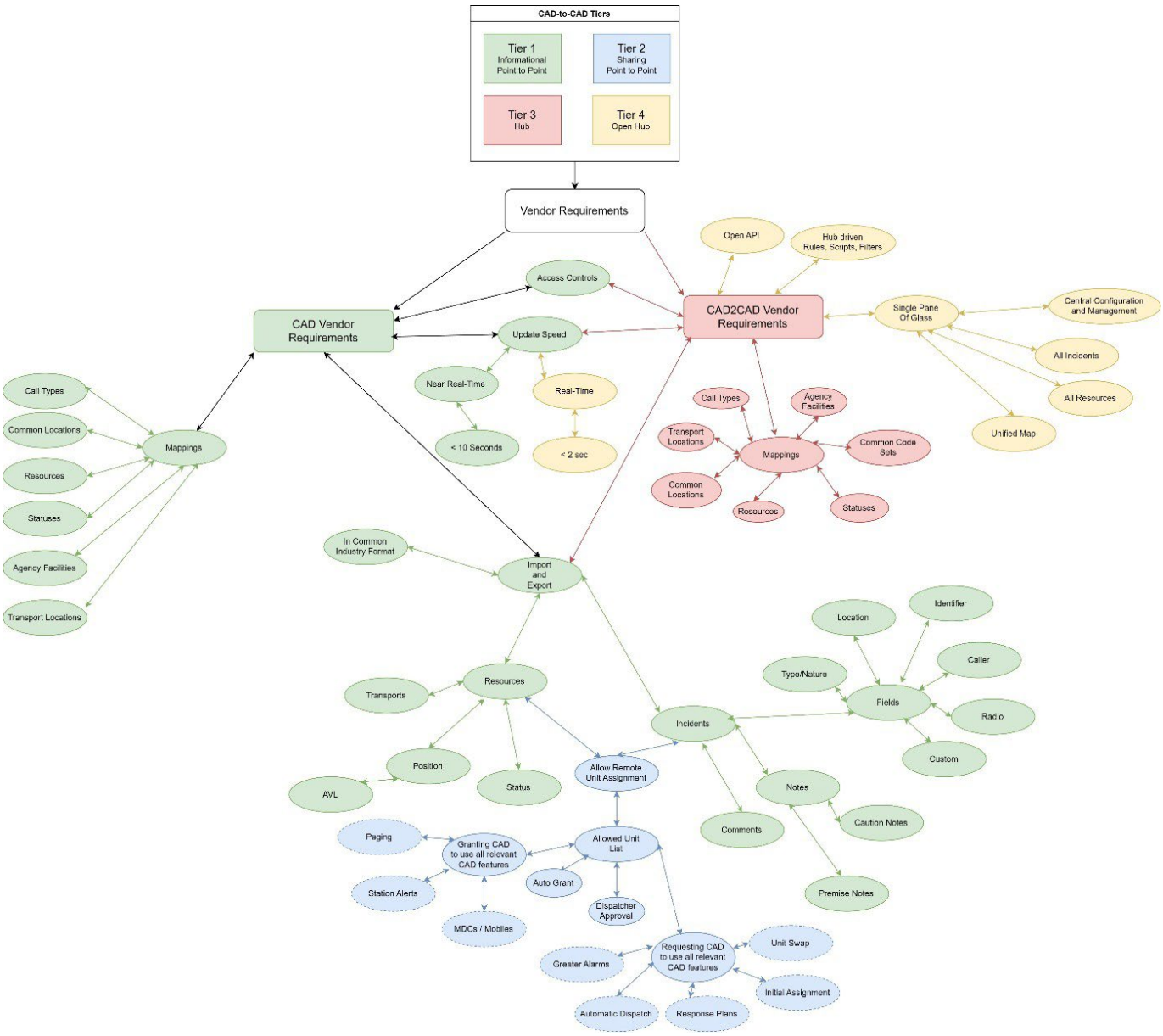
Agreements


Cross Agency Retention Periods
CAD-to-CAD Tiers
Tier 1 Informational Point to Point
Tier 2 Sharing Point to Point
Tier 3 Hub
Tier 4 Open Hub
Retention
Visibility
Agreements
Mutual Aid
Automatic Aid
Resharing
Security
HIPAA
PRA
3rd parties
CLETS
CJIS
PII

Technical


CAD-to-CAD Tiers
Tier 1
Informational
Point to Point
Tier 2
Sharing
Point to Point
Tier 3
Hub
Tier 4
Open Hub
SQL
Other
Database
API
HTTPS
Network
VPN
Webhook
Tunnel
Method
File Drop
Technical Specifications
CSV
XML
Format
YAML
JSON
EIDO
Binary
Protobuff

Minimum Requirements



Full Mind Map

