



SIRN 20/20 ARCHITECTURE, IMPLEMENTATION AND MIGRATION PLANS OVERVIEW

11.1 FINAL REPORT SUPPLEMENTAL DOCUMENT

Contract Deliverable # 9

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Document Overview

This document provides an overview of the Proposed North Dakota Statewide Interoperable Radio Network (SIRN) Network Architecture and Implementation Plans including:

- General SIRN Architecture Overview
- A synopsis of the various elements and subsystems
- Network Usage Scenarios
- Possible implementation and migration plans
- Operational and Sustainment Structure

SIRN Technology and Architecture Overview

- **Holistic Approach:** At a high level, SIRN would serve as the primary mission critical voice communications system for all State, Local and Tribal entities across the State of North Dakota.
- **Integrated:** SIRN would additionally support or interface with several other applications within the communications ecosystem such as Computer Aided Dispatch, Fire Station Alerting Systems, Logging Recorders, Paging Solutions, and other broadband solutions.

Needs and Objectives

ATTRIBUTE	BASELINE OPERATIONAL NEEDS	OBJECTIVES
 <p>RADIO COVERAGE NETWORK SERVICE</p>	<ul style="list-style-type: none"> ▪ Equal or Better overall coverage than current systems (“Coverage Equivalence”) ▪ 95% Mobile Radio coverage in each county ▪ Portable Radio service along roadways and in populated areas ▪ Reliable in-building coverage in dense areas of the State 	<ul style="list-style-type: none"> ▪ Provide continuous and similar coverage experience for state, local and municipal users and services ▪ Leverage mobility management to enable seamless roaming and transition from tower to tower for all approved users ▪ Support individual agency or function, and “announcement” communications capabilities
 <p>FEATURES MAINTENANCE</p>	<ul style="list-style-type: none"> ▪ Inter-county and inter-state interoperability capabilities ▪ Fire and EMS paging systems support ▪ PSAP applications integration capability ▪ Network features capability support¹ ▪ Reliable and timely maintenance and issue resolution 	<ul style="list-style-type: none"> ▪ Develop solution that delivers or incorporates all land mobile radio based services and applications as an integrated service ▪ Support communications among any and all radios and dispatch centers at all times by linking all wireless and wired services ▪ Ensure regional support and maintenance of all integrated elements through central remote monitoring and resolution by distributed staff

¹ “Support” refers to the ability of SIRN to latently support agency or county specific features. These features may not be initially delivered; however, SIRN would originally be designed to accommodate them and they may be funded by the agency requiring the feature.

SIRN 20/20 Network Elements

An illustration of a statewide architecture that integrates all system infrastructure, dispatch centers, end-user devices and, additionally, provides interfaces to ancillary applications and other neighboring state systems supporting regional and statewide day-to-day, mutual aid and large scale mission critical communications.

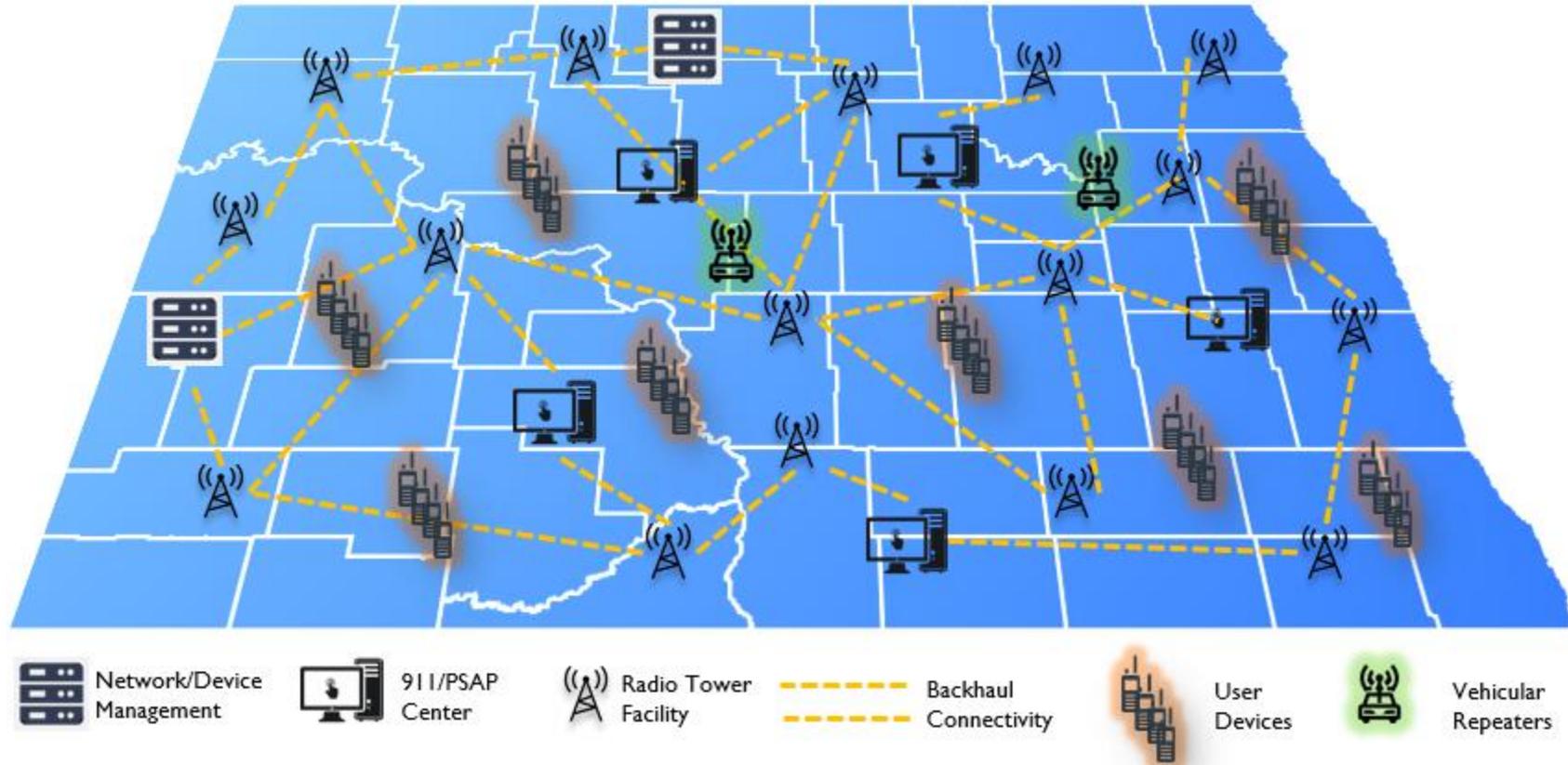


Figure 1: Core SIRN Elements Illustration

CORE SIRN SYSTEMS

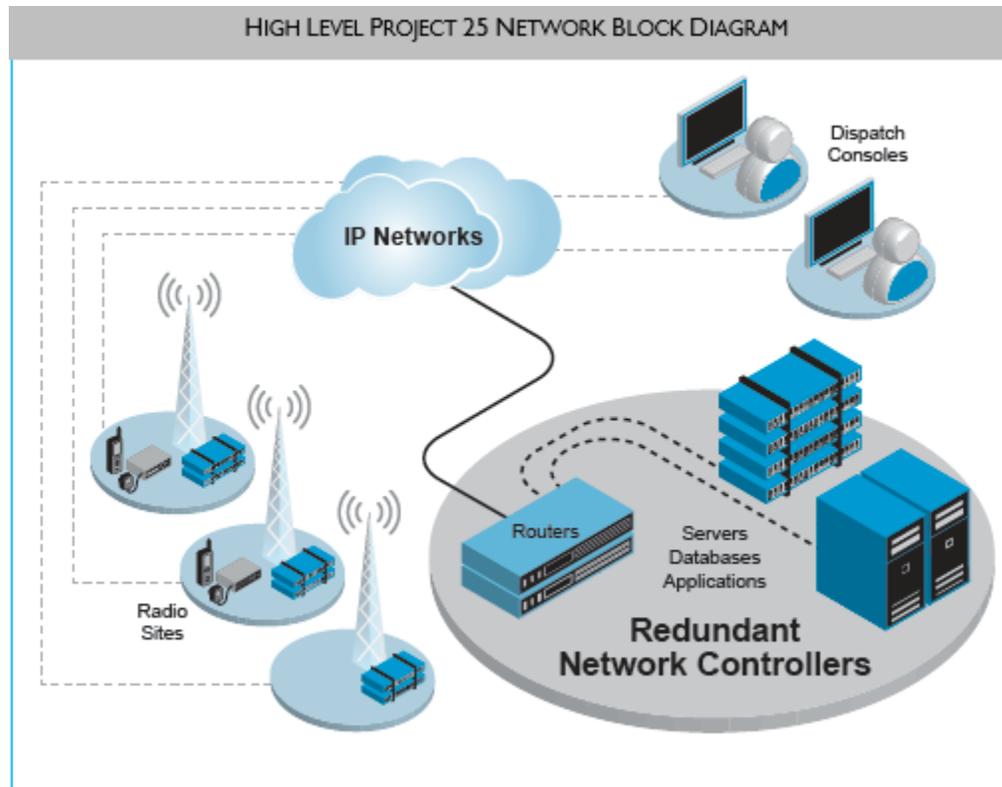
As depicted in Figure 1, SIRN is a complex and integrated network comprised of several key elements:

- **Network Management:** Includes centralized and/or distributed network systems that manage mobility, maintain device registration and databases.

- **Remote Base Stations:** Field radio tower facilities supporting wireless access of devices based on a hybrid VHF and 800 MHz spectrum.
- **Backhaul Connectivity:** Fiber and/or microwave based network connectivity.
- **Dispatch Centers:** Dispatch consoles distributed across the State's 23 Public Safety Answering Points.
- **Devices:** End-user devices including control stations, mobile and portable radios, as well as network relays such as Vehicular Repeaters.

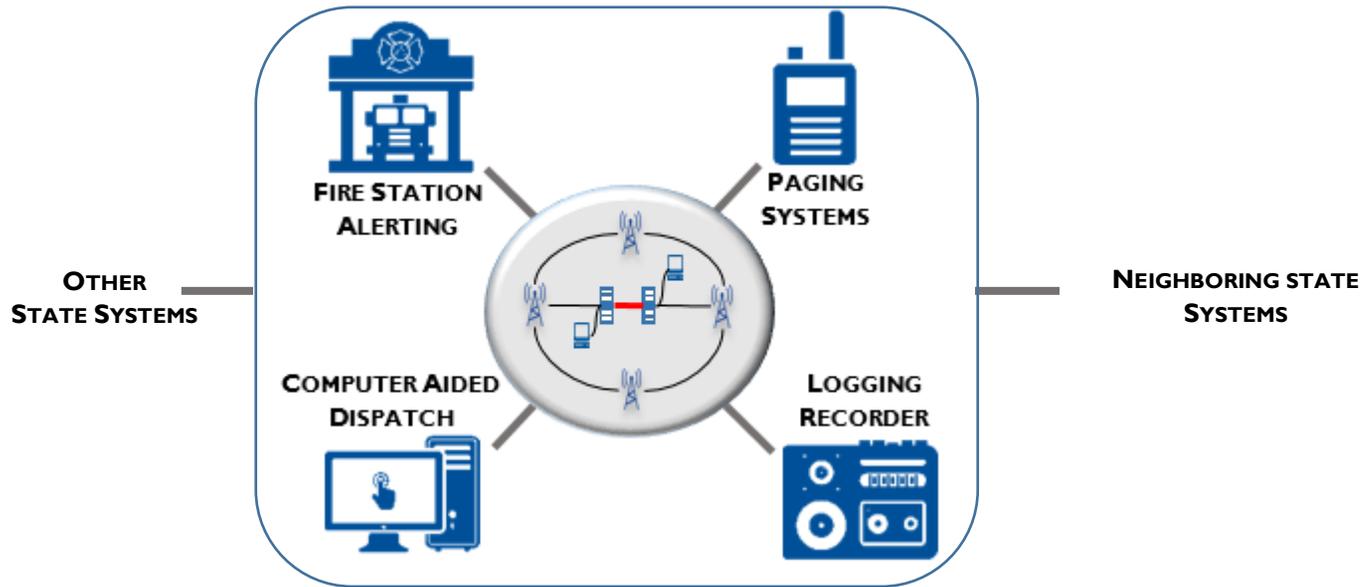
LOGICAL NETWORK DIAGRAM

The following diagram illustrates a logical network architecture for SIRN 20/20 with redundant controllers and connectivity with radio sites and dispatch centers.



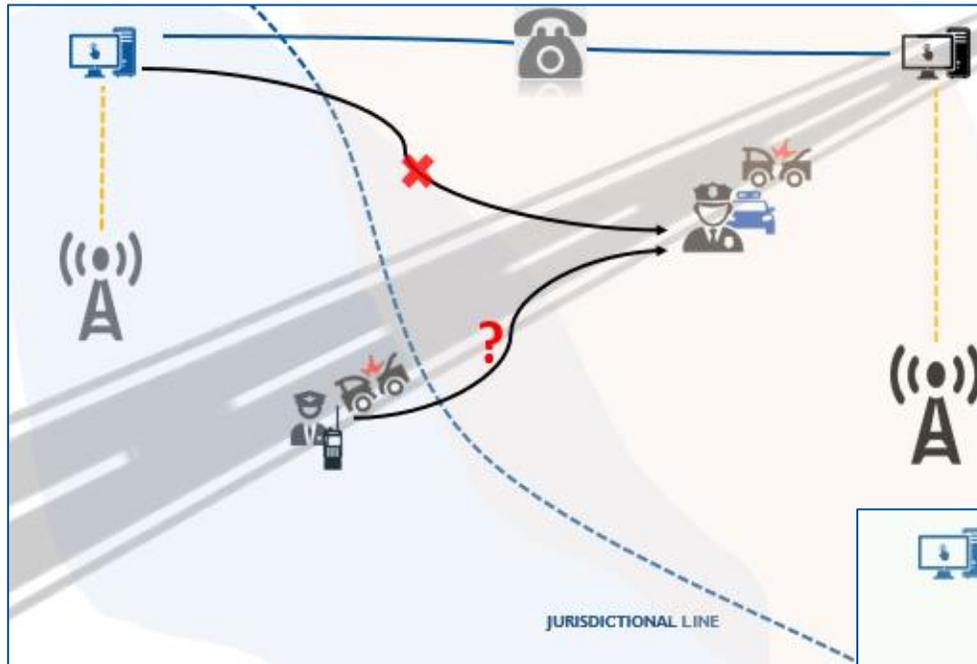
ANCILLARY SYSTEMS

Upon full deployment, SIRN would additionally integrate or provide interfaces to other applications and networks (such as neighboring state, federal, and other systems) through standardized IP interfaces or Radio Gateways.



Network Usage Scenarios

CROSS-JURISDICTIONAL INTEROPERABILITY (E.G. CAR CHASE)

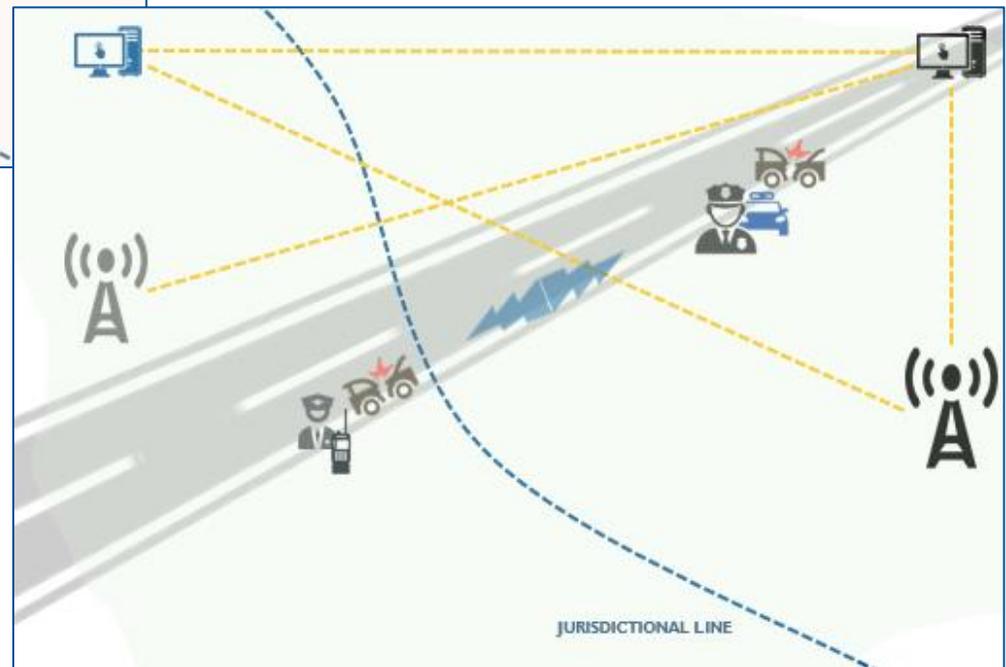


Current systems do not fully support network based inter-jurisdictional interoperability.

- Once pursuing LE is beyond his/her jurisdiction's coverage footprint, access to home PSAP is lost
- LE, if pre-configured, may switch channels to neighboring radio system; however, "no caller ID" for visited PSAP
- PSAPs may use landlines to relay information
- However, direct communication between LE's in the field is limited while in mutual aid pursuit
- If within unit-to-unit radio, both LEs may use Bank 5 for direct communication
- However, once on Bank 5, neither PSAP can hear their respective LEs in the field

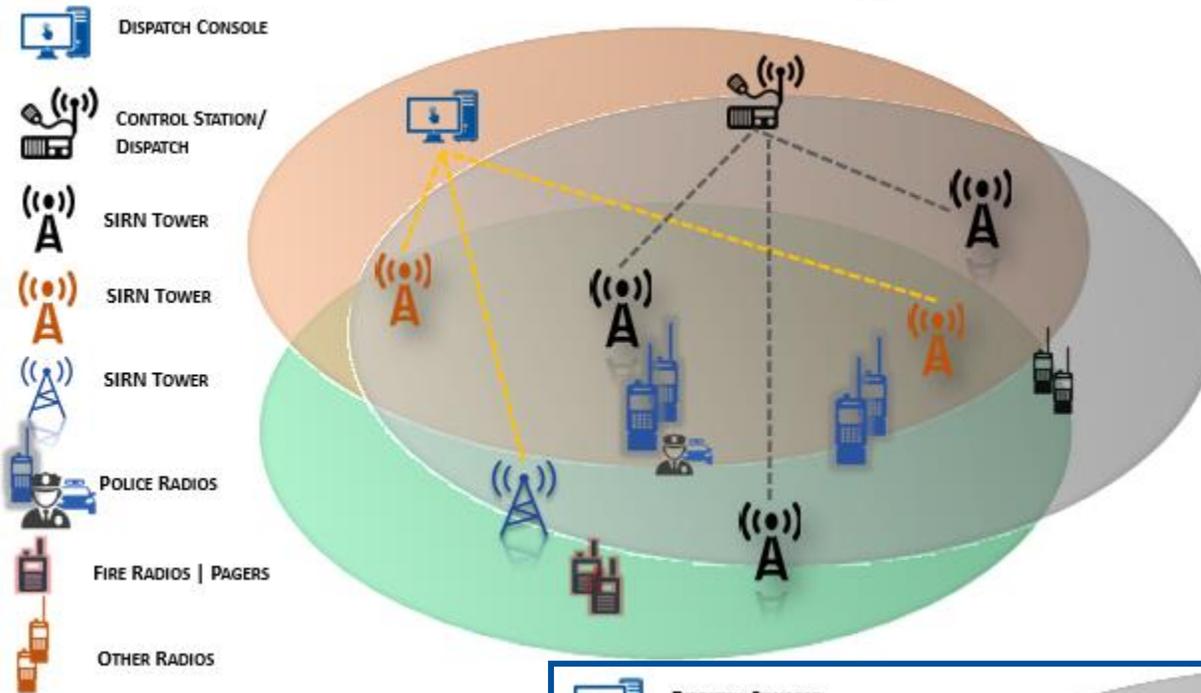
An integrated SIRN can support

- **continuous communications among all** pertinent PSAP and LEs in the field
- **while in pursuit** as well as **on scene**



DAILY INTRA-COUNTY OPERATIONS STREAMLINE (E.G. LARGE COUNTIES)

CURRENT



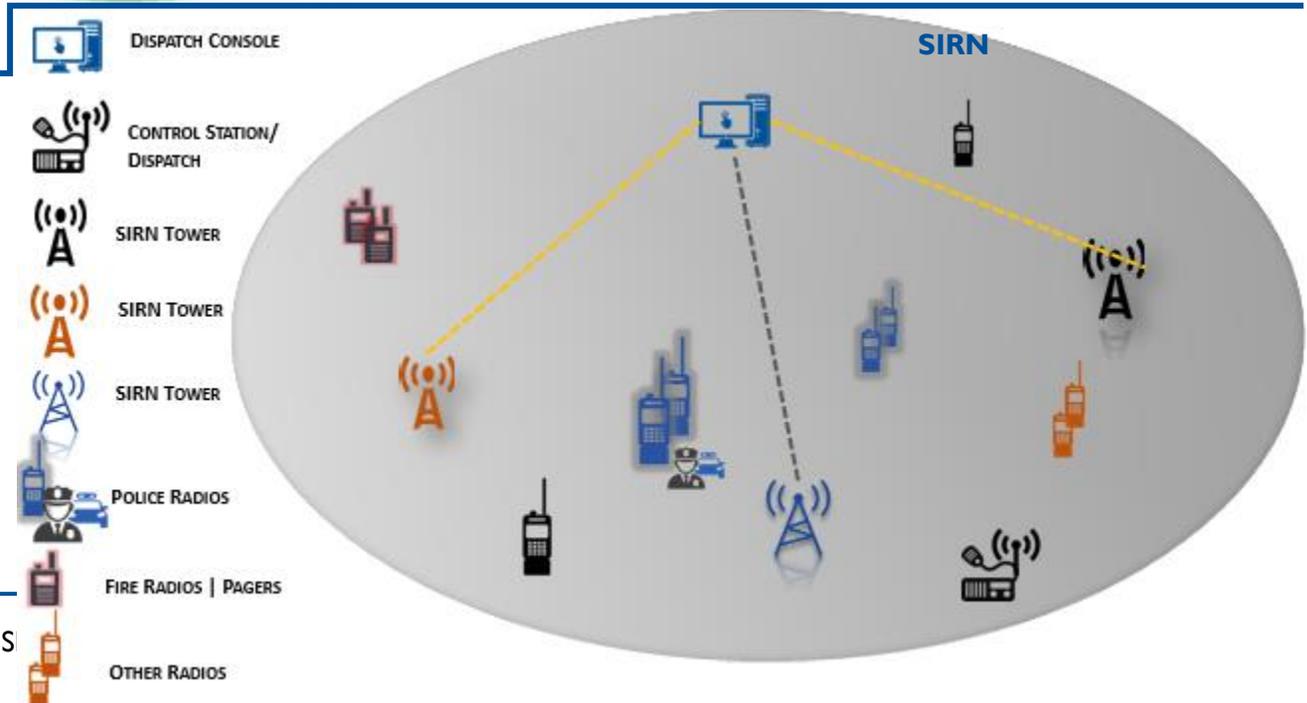
Current

Complicated Systems serving Large & Diverse User Base

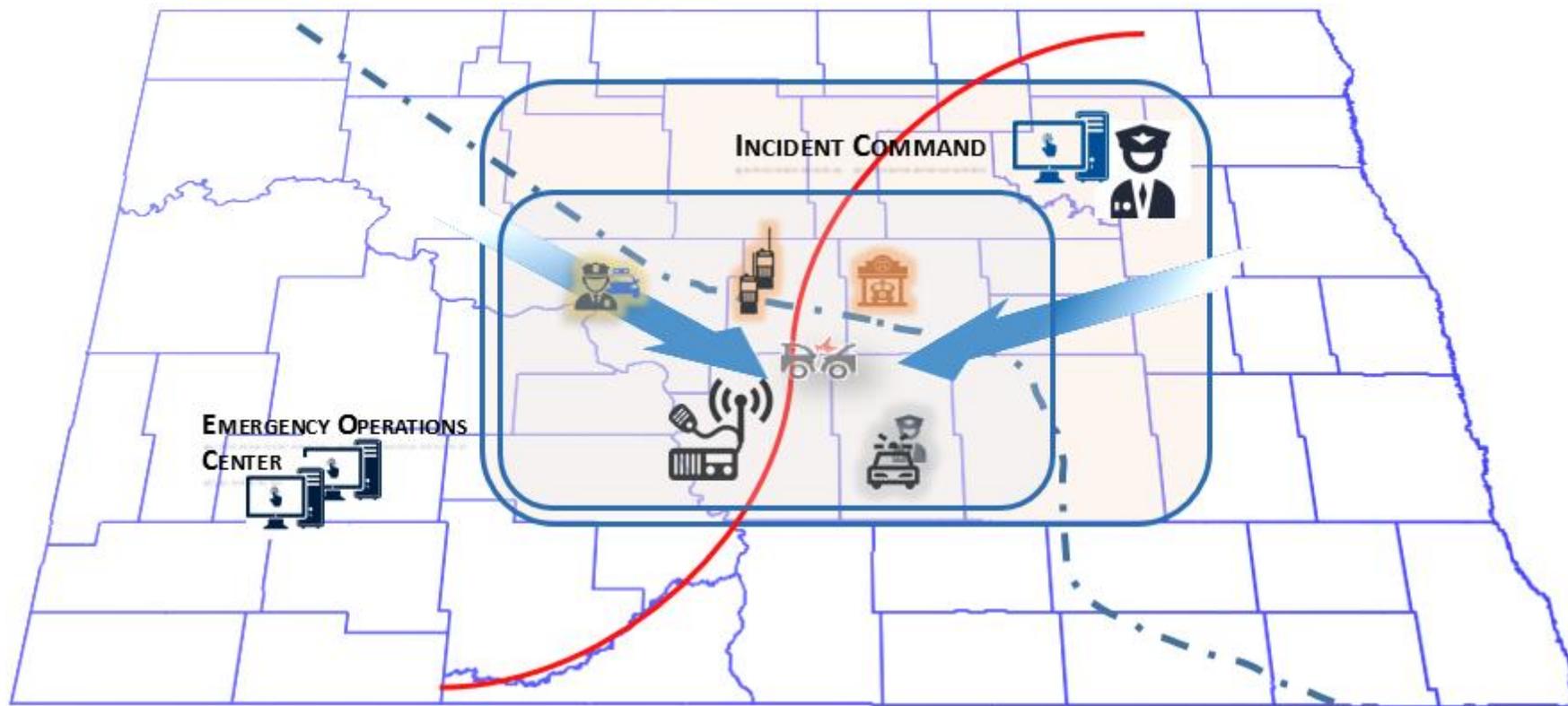
- Multiple independent systems which may or may not be interoperable
- Each agency may use multiple towers to ensure coverage footprint; therefore, different users have varying “service levels” at the same place
- Some agencies use wired dispatch consoles; others may use over-the-air control stations

SIRN

One Simpler System serving the Same Large & Diverse User Base



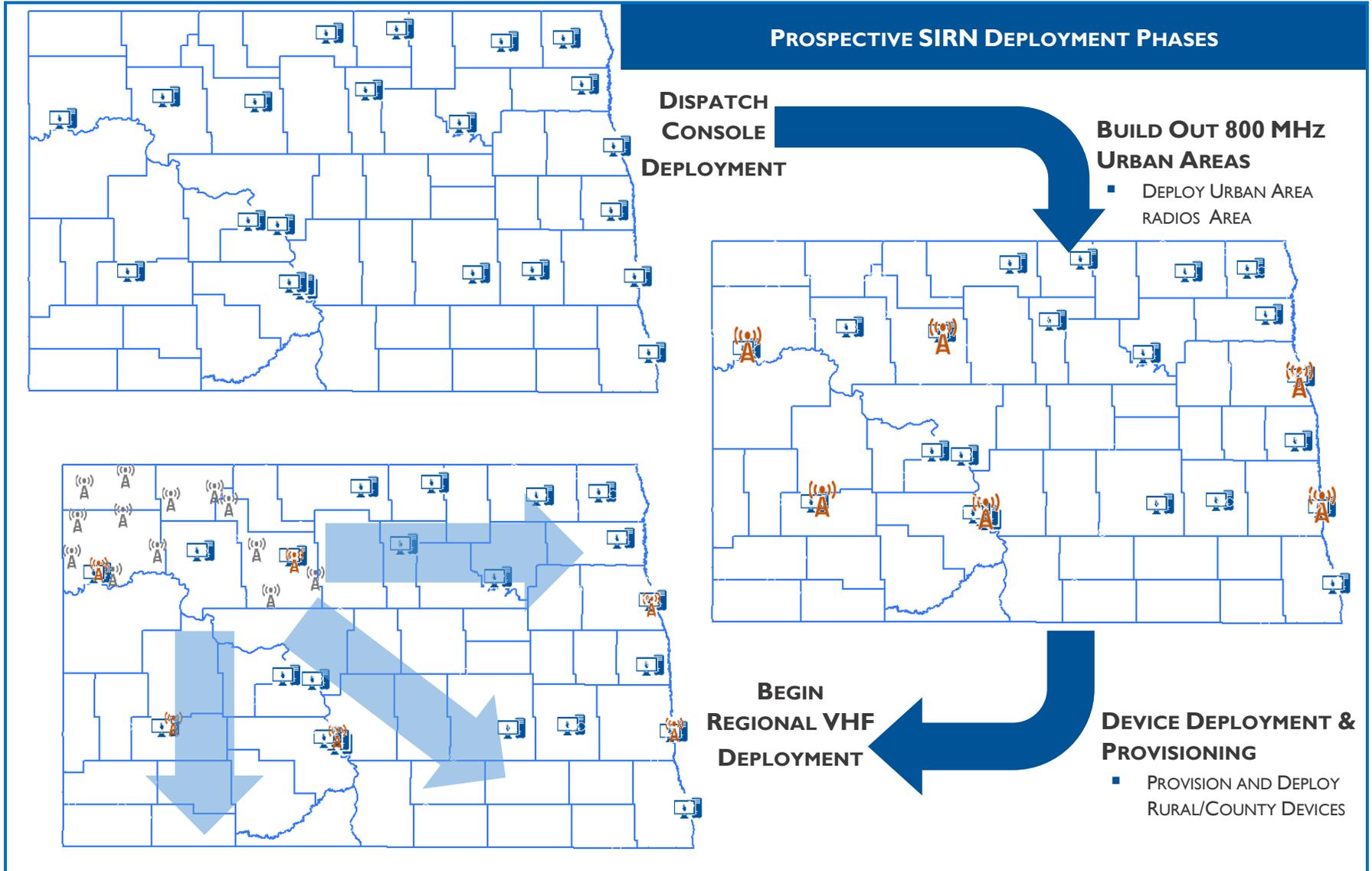
LARGE EMERGENCIES OR INCIDENTS



Supports local and wide area communications among various state and local emergency service functions at remote locations and on-scene.

Preliminary SIRN Deployment and Migration Plan

The deployment of SIRN may follow a variety of approaches, some of which are discussed in this section. A potential deployment sequence is illustrated below.

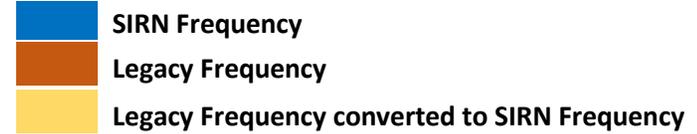


- **Console Deployment:** Most dispatch console equipment is nearing its serviceable lifespan. In addition, dispatch centers are the focal point for processing and disseminating information, and therefore have to support communications with legacy and newly deployed devices in the State. Therefore, console deployment, along with all related central networking and management systems, would be deployed first. SIRN, coupled with the Project 25 set of standards, does provide the flexibility, if necessary, for local PSAPs to purchase their own standards-based dispatch consoles.
- **General Site Preparation and Design:** Once the coverage design is finalized, radio site preparation begins. These tasks, which include site surveys, structural analyses, permitting, etc., can be pursued parallel to the console deployment and continue during the ensuing steps as well.
- **Radio Provisioning and Deployment:** Ensuring that end-user devices can support legacy and new networks, while maintaining interoperable communications during the migration to SIRN, will require a concerted effort by all affected stakeholders. Users have to be equipped with properly provisioned radios that can communicate over both networks prior to transitioning to SIRN.
- **800 MHz Urban Area Build-out:** 800 MHz deployment in the Urban Areas is recommended as the initial phase of network deployment for the following reasons:
 - Vacate a portion of the VHF frequencies for incorporation into the VHF SIRN layer
 - Release upgradeable VHF radios to be provisioned for use by Rural/County users
 - Supports a pilot phase as the legacy VHF networks and 800 MHz networks can co-exist to further validate SIRN
 - Supports better interoperability with their counterparts for cities along the Minnesota border
 - Delivers critical in-building portable coverage to major urban areas
- **Regional VHF Network Deployment:** Given the scope of the VHF network deployment, SIRN would be deployed in regional increments. Various activities have to be coordinated within the regional and surrounding counties to limit disruption of daily and incident communications. Radios within each region would be configured to communicate over the legacy and new network(s).

FREQUENCY COORDINATION AND IMPACT ON DEPLOYMENT

Due to the complexity and potential challenges of the radio frequency coordination effort, with a primary objective to maintain interoperable communications during the transition, the final transitional frequency site configurations can be categorized as follows²:

² A comprehensive Frequency Survey and Plan discussion is provided separately.



Site Classification	Transition Period	Final State
<p>Full Co-existence: Sites at which all legacy and SIRN can co-exist with sufficient isolation. In particular, because of the widespread use of the State Radio (SR) channels, SR sites have been designed such that all SR frequencies can co-exist with SIRN channels during and after deployment.</p>		
<p>Partial Co-existence: Sites at which only some legacy and SIRN channels can co-exist with sufficient isolation. At these sites, some legacy channels will either have to be phased out (for use elsewhere), or repurposed for SIRN at that location.</p>		
<p>No Co-existence: Because some sites may not be able to maintain any of the legacy channels in place, during the transition period only a portion of both the legacy and SIRN channels will be active at any given time. Therefore, there will be limited capacity on both systems, which may require different agencies to share a channel for a limited period of time.</p>		

Note that in an ideal state, there is limited to no need for legacy frequencies upon full deployment of SIRN as it is intended to support all communications. Therefore, the third example in the table above, while non-ideal during the transition phase, poses no issues if SIRN has broad participation and fulfills its objective of serving all users statewide.

Implementation and Operations Plan

Implementation of SIRN, from a programmatic standpoint, will require a well-conceived and coordinated effort among a wide range of stakeholders; these stakeholders may be classified into the SIRN Operating Entity, SIRN Vendor(s) and Public Safety Community and the Governance Body (see further descriptions). The table below illustrates the project impact and workload for each of these entities across the various elements of the project based on a tentative five year deployment schedule.

		Work Load				
		Year 1	Year 2	Year 3	Year 4	Year 5
Project Initiation Ratification	SIRN Operating Entity	Low	Low			
	SIRN Vendor(s)					
	Public Safety Governing Bodies	Low	Low			
Procurement Phase	SIRN Operating Entity	Low	Low	Low	Low	Low
	SIRN Vendor(s)		Low	Low	Low	Low
	Public Safety Governing Bodies	Low	Low	Low	Low	Low
Engineering & Planning	SIRN Operating Entity	Low	Low	Low	Low	Low
	SIRN Vendor(s)	Low	Low	Low	Low	Low
	Public Safety Governing Bodies	Low	Low	Low	Low	Low
Civil Improvements	SIRN Operating Entity	Low	Low	Low	Low	Low
	SIRN Vendor(s)		Low	Low	Low	Low
	Public Safety Governing Bodies	Low	Low	Low	Low	Low
Subscriber Provisioning/ Deployment	SIRN Operating Entity	Low	Low	Low	Low	Low
	SIRN Vendor(s)		Low	Low	Low	Low
	Public Safety Governing Bodies	Low	Low	Low	Low	Low
SIRN Network Deployment	SIRN Operating Entity		Low	Low	Low	Low
	SIRN Vendor(s)		Low	Low	Low	Low
	Public Safety Governing Bodies		Low	Low	Low	Low
SIRN Operations	SIRN Operating Entity	Low	Low	Low	Low	Low
	SIRN Vendor(s)		Low	Low	Low	Low
	Public Safety Governing Bodies	Low	Low	Low	Low	Low

Each entity discussed in the graphic is defined as follows:

- **SIRN Operating Entity (SEO):** Refers to the organization that manages and oversees SIRN implementation and operations. This organization, further defined in the Governance Report, may be composed of full-time and part-time state, local, contractor staff. The SEO is actively engaged throughout all phases of the project and spearheads all SIRN activities.
- **SIRN Vendor(s):** Refers to the vendor community that will provide goods and services.
- **Public Safety & Governing Bodies:** Refers to the end-user stakeholders and their representatives. The Governance Organization will be responsible for both programmatic and operational decisions during SIRN implementation. The illustration depicts the impact and engagement SIRN will have on the end-user community.

SIRN Operations and Structure Composition

A well-structured process for the sustainment and on-going operations of SIRN is fundamental for ensuring the reliable functionality of the network. The SIRN operating entity, as defined in the previous section, would be responsible for Operations and Maintenance (O&M) of SIRN. The O&M functions can be insourced, outsourced, or delivered in a hybrid combination of insourced and outsourced staff and services. SIRN O&M requires a range of technical, programmatic and operational personnel as illustrated below. The Governance Organization, in conjunction with the Operating Entity, has to create the SIRN O&M organization during the implementation period to ensure a fluid transition when the system is deployed. Given the scope of the system, SIRN will require **regional** systems personnel to support daily operations, maintenance, and stakeholder agency engagement. To maintain mission-critical service, regional “service shops” have to be within 2 – 4 hours of a cluster of their designated radio sites.

PROJECT MANAGEMENT AND ADMINISTRATION

- Overall project management and vendor oversight
- Contracts administration and logistics
- Financial management
- Regional leadership, training and support

NETWORK OPERATIONS AND MONITORING CENTER

- Daily network performance monitoring
- IT Support and customer service
- Quality Assurance
- Network/Device configuration and provisioning

FIELD INFRASTRUCTURE AND DEVICE MAINTENANCE

- Regional Radio system and infrastructure maintenance
- Break-Fix support
- Device maintenance

SYSTEM ENGINEERING AND NETWORK PLANNING

- Network engineering and analytics
- Performance management