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# ARKnet Deployment System Design Document

Cupertino Citizens Corps

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Revision 1.2, **WIP**



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### Revision

Rev	Date	Comments
1.1	11/11/2015	Update
1.2	1/14/2016	Update

# 1 Introduction

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The System Design Document (SDD) describes how the functional and nonfunctional requirements recorded in the Requirements Document are transformed into more technical system design specifications from which the system will be built.

## 1.1 Purpose of the System Design Document

The System Design Document documents and tracks the necessary information required to effectively define the architecture and system design to give the project team guidance on architecture of the system to be developed. Design documents are incrementally and iteratively produced during the system development life cycle, based on the particular circumstances of the project and the system development methodology used for developing the system.

This document is a work in progress. It will be sufficiently complete to describe the overall solution, and guide the immediate next steps in the design and build process. It also will be updated periodically as the state of the design progresses.

The SDD's intended audience is the project manager, project team, development team, and served agencies. Some portions of this document such as the user interface (UI) may on occasion be shared with the user and other stakeholder whose input/approval into the UI is needed.

## 2 General Overview, Design Guidelines/Approach

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### 2.1 Overview

The ARKnet Deployment Project will deploy an emergency wireless network to specific named sites located in Cupertino. This network, essentially a Cupertino Emergency Wireless Intranet, will be used during emergencies by the Cupertino Citizen Corp and City staff as required. Other uses may be identified and deployed as necessary.

#### 2.1.1 Purpose, Objectives

Cupertino has 6 ARKs (shipping containers of emergency supplies) located throughout the city. In the event of an emergency, members of CERT, CARES, and MRC (Cupertino Citizen Corps) will converge, self-organize, and deploy into the surrounding neighborhoods to assist the community with stabilizing the situation and assisting with the recovery. Information about the response – staffing levels, reported problems, and progress to their resolution – is critical to the success of the responders. This information, when shared with the EOC, can also give the city an over-the-shoulder look at what is happening in the field.

Additionally, the City of Cupertino has several sites and facilities that will be engaged as part of the community response. In the event of a city-side communications failure, communications with these facilities to support the city's emergency response will be critical.

Lastly, there are specific served agency sites within the City that would also benefit from access to ARKnet, including, but not limited to: resident SCC Fire stations and Cupertino Sanitary District.

#### 2.1.2 Scope of Project

All 6 ARKS, the EOC, and any designated City or Served Agency sites, will connect to the ARKnet emergency network. One or more high altitude wireless sector sites will be established (such as Montebello Apartments, the Cypress Hotel, Lehigh Permanente Plant). The number of sites will depend on the results of Site Surveys performed at each of the Client Sites once the first sector site is in place.

Client sites (ARKs, others) will connect to the Sector Site using standard 802.11 wireless networking equipment and protocols.

Once the network is established, the following applications are planned for deployment (to name a few):

1. VoIP phone system
2. File Sharing
3. Instant Messaging
4. Web page serving and information downloads
5. Video streaming
6. End-user messaging
7. WebEOC data entry and access

Users of ARKnet would use the above applications include:

1. Cupertino Citizen Corps members who respond to the ARKs, ICP, or other requested field location.

2. Cupertino EOC staff that require information from or contact with field responders.
1. City emergency responders and staff at City sites where the network is deployed (Quinlan Center, Service Center, Traffic Department, etc.).

## 2.2 Assumptions, Constraints, Risks

### 2.2.1 Assumptions

The following assumptions are made about the ARKnet operations.

1. The Emergency Network would always be on and operational once fully deployed.
2. Internet throughout the city is unavailable.
3. Telephone services – wired and wireless – are limited or unavailable.
4. The Network operates under FCC Type 15 rules (no radio or operator license required).
5. All equipment is commercial grade. Other than configuration, application setups, and packaging, no custom solution is planned.
6. Cupertino Citizens Corps will provide the resources to support and maintain the network environment once deployed.

### 2.2.2 Constraints

The following are limitations or constraints that may have a significant impact on the design of the system's hardware, software and/or communications, and describes the associated impact.

1. Security requirements. Because the system will be always on, placement of equipment in the field needs to be done in a manner that ensures that the network equipment at each field site is secure.

### 2.2.3 Risks

The risks and mitigation plans are as follows:

Risk	Mitigation
1. RF platform placement. Cupertino is a city with tall trees, some of which will create obstacles between deployment sites.	If RF Line of Sight cannot be achieved, then additional sector sites will be investigated.
2. Insufficient performance from the 5.8GHz radio band selected for this network	Explore other frequency ranges such as the 4.9GHz public safety band.

## 3 Design Considerations

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### 3.1 Goals and Guidelines

#### 3.1.1 Goals

The primary goal of the solution is to deploy a cost-effective, reliable, and supportable emergency wireless infrastructure to support the City responders during an emergency.

#### 3.1.2 Guiding Principles

The following guiding principles are put forth in support of the design process:

1. Make vs Buy. Whenever possible, the project team will pursue a BUY decision and look for commercial off the shelf (COTS) products to incorporate into the design.
2. Leverage City Staff and Volunteer resources. Whenever necessary, look within the City and volunteer organizations for resources to help address and resolve problems.
3. The project team will follow standard industry practices for coding, configuring, and documenting the solution.
4. The project team will comply with standards and codes regarding structural installation and power management.
5. When accessing sites not directly under the control of the City, formal agreements will be established that lay out deliverables, responsibilities, and conditions under which site access will be allowed.

#### 3.1.3 Development Methods & Contingencies

The approach we will take with the system design will be RAD (Rapid Application Development) modified to account for the solution requiring extensive configuration with minimal coding.

#### 3.1.4 Architecture Strategies

The following design decisions have been made:

1. Wireless Product Selection. MicroTik wireless access points are unique in that they both integrate directional antennas and support for industry standard routing protocols in a single device, which will minimize per-site expenses.
2. Application Leverage. We will implement industry standard applications that are both in active development and have a sufficient support infrastructure.
3. Scalability. The solution will be implemented to ensure that we can deploy additional sites without impacting performance for the initial user community.
4. User adoption. The solution will leverage existing end-user client devices (iPhones, iPads, tablets, PCs, netbooks, etc.) to avoid the learning curve of introducing a different operating paradigm.
5. Standard Protocols. The solution will use IEEE and ANSI standard network protocols. No custom protocol work is planned.

6. **Distributed Data.** The solution will support remote server access by allowing network servers to be placed at any operating node.
7. **Distributed Control.** The solution will be configured with a priority for access security to allow remote maintenance and administration.
8. **Self-healing.** Critical systems such as the EOC server will not be tied to a single physical location in the network. Should any links in the network fail during use and it is possible to route around the failure, it will happen automatically with limited or no user intervention.



## 4 System Architecture and Design

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This section outlines the system and hardware architecture to be built.

### 4.1 Overview

ARKnet is a collection of hardware components, configurations, and commercial software that enables passing information between participating sites over a wireless network. ARKnet is the infrastructure on which networked applications can operate. When ARKnet is connected to local Ethernet switches and wireless access points, client devices (iPhone, iPads Tablets, PCs, netbooks, etc.) can access applications and data that reside on both local and remote ARKnet servers.

For instance, the following applications are planned to be deployed on ARKnet:

1. VoIP phones. An Asterisk PBX Phone software is installed on an ARKnet server. When configured, a user at one field site can “make a phone call” to a user anywhere on the network.
2. File sharing. FTP (File Transfer Protocol) is one method to transfer large files, such as an mpg4 (video) or large data files (spreadsheets, documents, etc.).

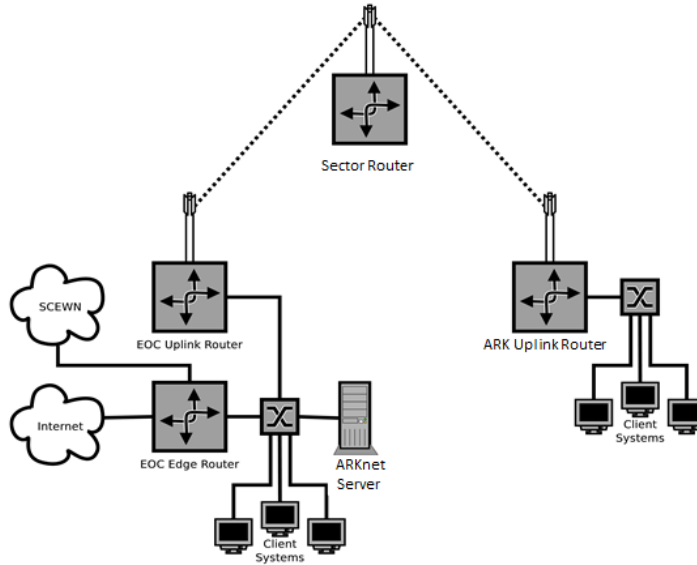
For instance, an FTP server is setup on a network server somewhere on ARKnet. A user shoots a video with his/her iPhone, and then using an app like “FTP Client Pro” (\$5 at the Apple Store), can select and PUT the video on the FTP server. The file can then be retrieved either directly or by an FTP GET from the server, or mapped onto File Share.

3. Instant Messaging / Chat. Many chat clients, such as Pidgin and HexChat, support the Internet standard Internet Relay Chat (IRC) protocol. An IRC server will run on ARKnet and allow users to send direct messages to other users as well as join ad-hoc chat rooms to talk to multiple users at once.
4. Web page serving. All devices have some type of browser built in. An ARKnet web server will be installed and configured with the Apache web server software. User forms, manuals, and other reference data can be loaded and served to users using standard browser software.

## 4.2 Hardware Architecture

### 4.2.1 Network Architecture

The overall network architecture will follow the STAR model. High altitude sector sites will service all client sites.



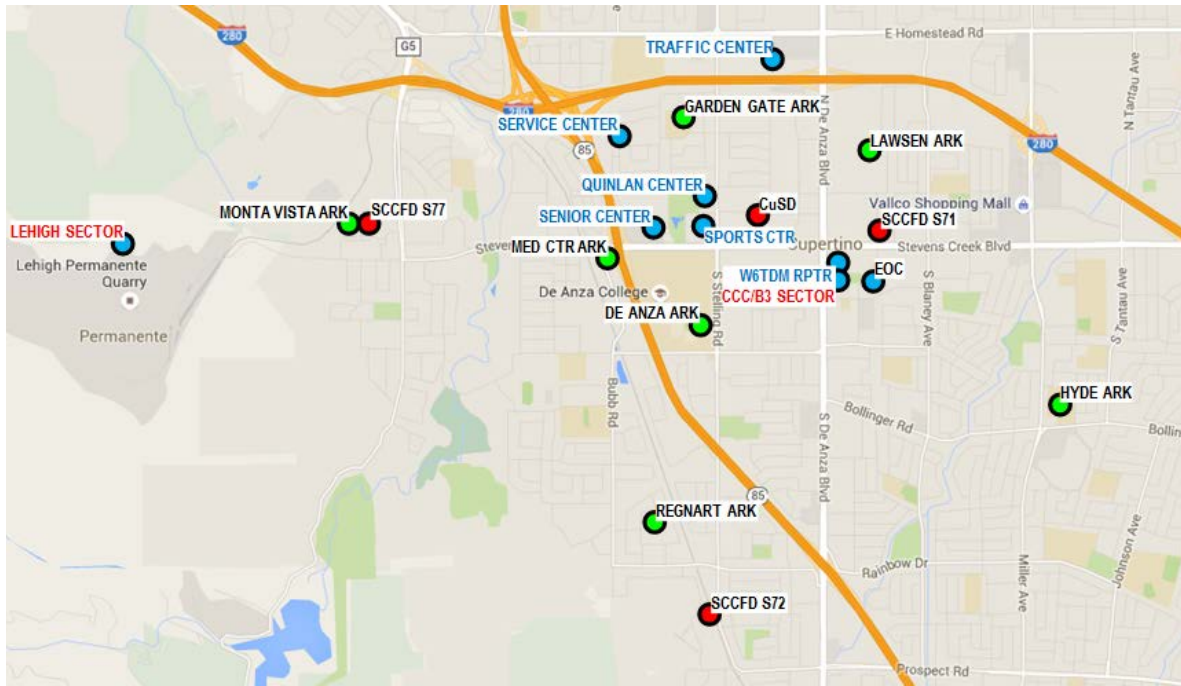
### 4.2.2 Site List

Network hardware will be deployed to the following sites:

Site Type	Description	Contact
Sector	Cupertino Civic Center, Building 3	CARES
	Lehigh Permanente Cement Plant	CARES
Field Client	De Anza ARK	CCC
	Regnart Elementary ARK	CCC
	Hyde Middle School ARK	CCC
	Lawson Middle School ARK	CCC
	Garden Gate Elementary ARK	CCC
	Cupertino Medical Center ARK	CCC
	Cupertino Fire Station 71	SCCFD
	Seven Springs Fire Station 72	SCCFD
	Monta Vista Fire Station 77	SCCFD
Cupertino Sanitary District Office	CuSD	
City Client	EOC	Cup DPW
	OES Communications Van	Cup DPW
	Quinlan Center	Cup DPW
	Service Center	Cup DPW
	Senior Center	Cup DPW
	Traffic Ops	Cup DPW
Other	W6TDM Repeater Site	CARES
	system maintenance access #1	CARES
	System maintenance access #2	CARES
	Field Station	CARES

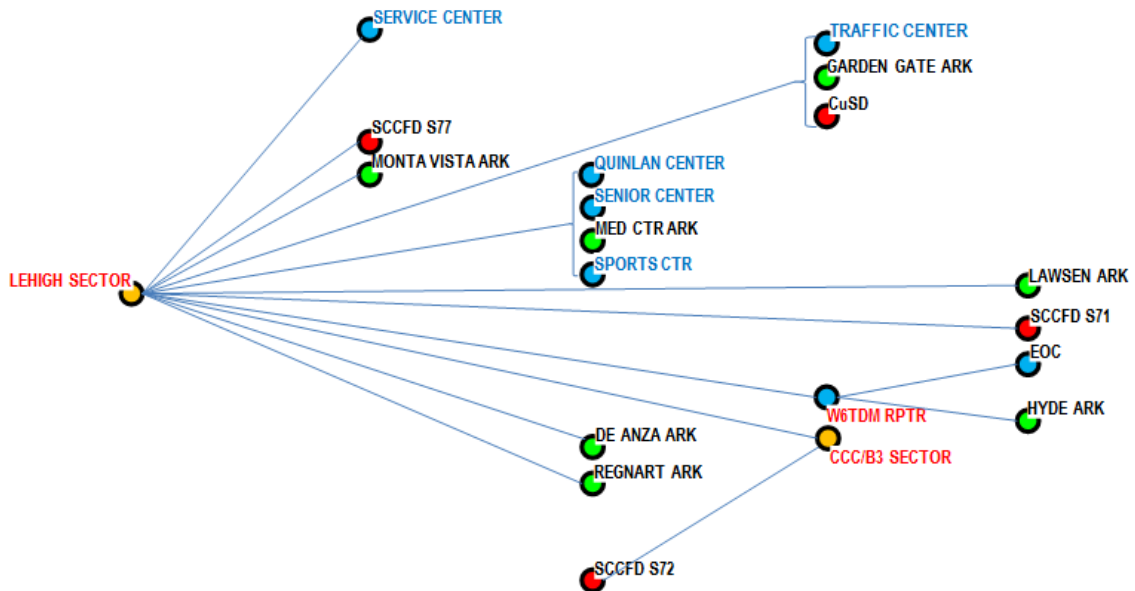
### 4.2.3 Physical Topography

Network hardware will be deployed to the following locations throughout the City:



### 4.2.4 Network Topography

The following is the proposed link plan for all sector and client sites. This plan will be updated as the project team completes client Site Surveys. Groups of sites are marked with a ‘{’ to improve readability.



#### 4.2.5 High level station configuration

Link	Site 1	Site 2	Type	Site Location	Elev ft	Client Antenna	Client Power	Notes
	Lehigh Sector		Sector	Lehigh Permanente Cement Plant, Northwest water tank	900	Water Tank Mounted antenna.	Pri: 160W Solar (320W) and battery (200Ah)	
	CCC/B3 Sector		Sector	Cupertino City Center, Building 3 20400 Stevens Creek Blvd		Site Survey Pending	Pri: 120VAC service Sec: Facility backup generator, else Battery	
	Lehigh Sector	CuSD	Agency	Cup Sanitary District 20863 Stevens Creek Blvd		Site Survey Pending	Pri: 120VAC service Sec: Facility backup generator if available.	
	Lehigh Sector	Med Center ARK	Agency	10050 Bubb Road, North side		Poll Mount Antenna, 20ft	Pri: 120VAC service Sec: Facility backup generator	
	Lehigh Sector	DeAnza ARK	ARK	DeAnza College, East side, south of Archery Range		Poll Mount Antenna, 20ft	Pri: Solar & Battery Sec: ARK generator	
	Lehigh Sector	Garden Gate ARK	ARK	Garden Gate Elementary School ARK is across from 21114 Greenleaf Dr		Poll Mount Antenna, 20ft	Pri: 160W Solar (80W) and battery (100Ah) Sec: ARK generator	
	W6TDM Rptr	Hyde ARK	ARK	Hyde Middle School 6151 Bollinger Rd		Poll Mount Antenna, 20ft	Pri: Solar & Battery Sec: ARK generator	
	Lehigh Sector	Lawson ARK	ARK	Lawson Middle School 10301 Vista Dr		Poll Mount Antenna, 20ft	Pri: Solar & Battery Sec: ARK generator	
	Lehigh Sector	Monta Vista ARK	ARK	Monta Vista Fire, west end of the building				
	Lehigh Sector	Regnart ARK	ARK	Regnart Elementary, 1170 Yorkshire Dr		Tree Mount Antenna, 40ft to clear tree blocks facing northwest	Pri: Solar & Battery Sec: ARK generator	
	W6TDM Rptr		City	Verona Homes 20488 Stevens Creek Blvd		Site Survey Pending	Pri: 120VAC service Sec: Facility backup generator	
	W6TDM Rptr	EOC	City	10300 Torre Ave		Roof-mount, 10 ft Mast	Pri: 120VAC service Sec: Facility backup generator	
	Lehigh Sector	Quinlan Center	City	10185 N Stelling Rd		Site Survey Pending	Pri: 120VAC service Sec: Facility backup generator	

Link	Site 1	Site 2	Type	Site Location	Elev ft	Client Antenna	Client Power	Notes
	Lehigh Sector	Senior Center	City	21251 Stevens Creek Blvd		Site Survey Pending	Pri: 120VAC service Sec: Facility backup generator	
	Lehigh Sector	Service Center	City	10413 Mary Ave		Roof-mount on existing antenna structure	Pri: 120VAC service Sec: Facility backup generator	secondary Internet Link
	Lehigh Sector	Sports Center	City	21111 Stevens Creek Blvd		Site Survey Pending	Pri: 120VAC service Sec: Facility backup generator	
	Lehigh Sector	Traffic Center	City	9 Franco Ct		Site Survey Pending	Pri: 120VAC service Sec: Facility backup generator	
	CCC/S3 Sector	SCCFD S71	SCCFD	Cupertino Fire 20215 Stevens Creek Blvd		Roof-mount on existing antenna structure	Pri: 120VAC service Sec: Facility backup generator	
	Lehigh Sector	SCCFD S72	SCCFD	Seven Springs Fire 21000 Seven Springs Pkwy		Roof-mount on existing antenna structure	Pri: 120VAC service Sec: Facility backup generator	
	Lehigh Sector	SCCFD S77	SCCFD	Monta Vista Fire 22590 Stevens Creek Blvd		Roof-mount on existing antenna structure	Pri: 120VAC service Sec: Facility backup generator	

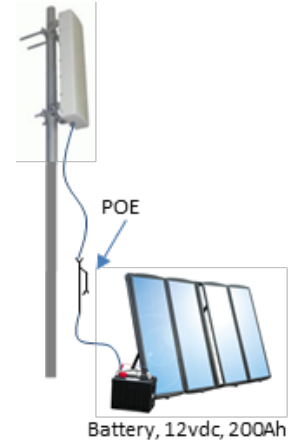
#### 4.2.6 Sector Site Architecture

Each Sector Site will be evaluated for its power requirements based on site available services. For instance:

1. CCC/B3 provides 120VAC service on the roof with emergency power generation in the building. A backup battery may be added if needed.
2. Lehigh Permanente Plant will be a stand-alone installation. Solar power with sufficient battery storage is planned.

The Sector Site Network hardware consists of the following:

3. Solar Power feeding Solar Battery Charge Controller (planned for Lehigh).
4. Power Supply / Battery Charge Controller (planned for CCC/B3).
5. Battery: 1 or 2 100Ah batteries.
6. POE adaptor; power over Ethernet. Connects the sector antenna to the power source.
7. MicroTik SXT SA5ac wide beam width sector antenna.



The configuration requirements are:

1. Microtik; link, local router

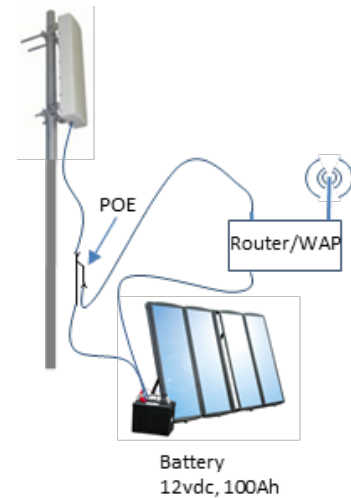
#### 4.2.7 ARK Site Architecture

The ARK Network hardware consists of the following:

1. Solar Power feeding Solar Battery Charge Controller or Power Supply / Battery Charge Controller.
2. Battery: 1 100Ah batteries.
3. POE adaptor; power over Ethernet. Connects the access point to the Battery and the Local Wireless Router.
4. MicroTik SXT 5ac access point.
5. Mikrotik RB951Ui Wi-Fi Access Point. Creates a Wi-Fi hotspot for local wireless and wired local users to the access point.

The configuration requirements are:

1. Microtik; link, local router
2. Wi-Fi access point: configure SSID, wireless secured access



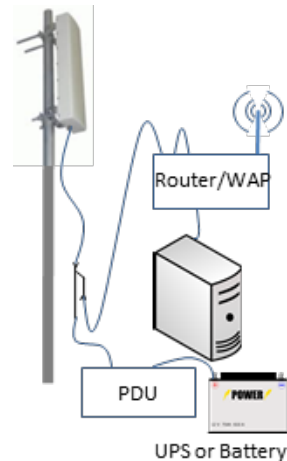
#### 4.2.8 Other Client Sites

SCCFD and Served Agency sites may be a variation of an ARK site.

#### 4.2.9 EOC Site Architecture

The EOC Network hardware consists of the following:

1. MicroTik SXT 5ac access point.
2. Mikrotik RB951Ui Wi-Fi Access Point.  
Creates a Wi-Fi hotspot for local wireless and wired local users to the access point.
3. POE adaptor; power over Ethernet.  
Connects the access point to the Battery and the Local Wireless Router.
4. ARKnet server
5. Edge router to provide connectivity between ARKnet and the Internet (not shown).
6. Power Adaptors: one each for the Router, Access Point, Edge router, and server.



The configuration requirements are:

1. Microtik; link, local router
2. Wi-Fi access point: configure SSID, wireless secured access
3. Server: All local services
4. Edge router: local routing

#### 4.2.10 Security Hardware Architecture

Security Hardware is limited to preventing physical access to all locations and radio equipment.

1. Sector Sites: Equipment will be installed on a roof or in a secured area, a controlled access space only available to maintenance and security, and visitors at the discretion of the Site Manager. No design action is required to secure a site.
2. Cupertino City Hall: a client site. Equipment will be installed on the roof, a controlled access space only available to City Maintenance, City Channel, and visitors at the discretion of the City. No design action is required to secure this site.
3. **ARK sites. Radio equipment will be installed on an antenna mast, and secured to the ARK exterior. Final placement of this equipment will be reviewed and approved by the Citizen Corps Coordinator to ensure any enclosure penetrations proposed are understood and the risks from a penetration is properly mitigated.**
4. City sites. Radio equipment will be installed on each facility's roof with review and approvals by the Cupertino DPW Facilities Supervisor.
5. Fire Station sites. Radio equipment will be installed on an existing antenna fixture at each station. Final placement of this equipment will be reviewed and approved by a designated SCCFD Communications contact.
6. Other Agency sites. Radio equipment will be installed on each facility's roof with review and approvals by the respective agency representative.

### 4.3 Software Architecture

The software architecture assumes Commercial off the Shelf components to be configured by project developed scripts.

The following is a list of software required to support the Deployment: This list may be updated as different or new solutions are identified.

Network Apps	Description	Reference
MicroTik Router OS	MikroTik RouterOS is the operating system of MikroTik RouterBOARD hardware. RouterOS is a stand-alone operating system based on the Linux v2.6 kernel This software comes installed on the MicroTik Access Point and sector antenna systems.	<a href="http://www.mikrotik.com/software">http://www.mikrotik.com/software</a>
Asterisk PBX	Asterisk is an open source framework for building communications applications. Asterisk turns an ordinary computer into a communications server. Asterisk powers IP PBX systems, VoIP gateways, conference servers and other custom solutions. It is used by small businesses, large businesses, call centers, carriers and government agencies, worldwide. Asterisk is free and open source. Asterisk is sponsored by Digium.	<a href="http://www.asterisk.org/">http://www.asterisk.org/</a>
FTP (vsftpd)	<b>vsftpd</b> , (or very secure FTP daemon), is an FTP server for Unix-like systems, including Linux. It is licensed under the GNU General Public License. It supports IPv6 and SSL.	<a href="https://security.appspot.com/vsftpd.html">https://security.appspot.com/vsftpd.html</a>
Apache	An open-source HTTP server for modern operating systems including UNIX and Windows NT. The goal of this project is to provide a secure, efficient and extensible server that provides HTTP services in sync with the current HTTP standards.	<a href="http://httpd.apache.org/">http://httpd.apache.org/</a>
Samba	An open-source SMB/CIFS server to provide file sharing between Windows and OSX clients. No additional software needed on client systems	<a href="http://www.samba.org/">http://www.samba.org/</a>
BIND	Industry standard DNS server to provide local domain name resolution to all clients on the ARKnet.	<a href="http://www.isc.org/downloads/bind/">http://www.isc.org/downloads/bind/</a>
Ngircd	An open-source Internet Relay Chat (IRC) server, which is an open and well supported standard for Internet chat rooms.	<a href="http://ngircd.barton.de/">http://ngircd.barton.de/</a>
Cacti	A web-based network monitoring tool used to continually collect telemetry about the network and present it to admins for monitoring	<a href="http://www.cacti.net/">http://www.cacti.net/</a>



User Apps	Description	Reference
Filezilla Client	FTP client for Windows systems	<a href="https://filezilla-project.org/">https://filezilla-project.org/</a>
FTP Client Pro	FTP Client, runs on Apple	<a href="https://itunes.apple.com/us/app/ftp-client-pro/id425341262?mt=8">https://itunes.apple.com/us/app/ftp-client-pro/id425341262?mt=8</a>
Pidgin	A free Peer to Peer chat program which lets you log in to accounts on multiple chat networks simultaneously.	<a href="https://www.pidgin.im/">https://www.pidgin.im/</a>
Bonjour	Also known as zero-configuration networking; enables automatic discovery of devices and services on a local network using industry standard IP protocols. Bonjour makes it easy to discover, publish, and resolve network services with a sophisticated, yet easy-to-use, programming interface.	<a href="https://www.apple.com/support/bonjour/">https://www.apple.com/support/bonjour/</a>
HexChat	A user-friendly chat client that supports the IRC protocol	
Chrome	A popular web browser to be used for accessing local and remote HTTP servers	

#### 4.4 Security Architecture

**January 14, 2016: CONFIRMATION PENDING:** Local services and access inside the ARKnet network will be built on the assumption of intrinsically trusting all hosts that have access to the network. No firewalls will be erected inside the network, and access to network services will use as few passwords as possible to maintain ease of use. Network security will be primarily built around securing access at each client site and strongly securing the backhaul links between sites.

The backhaul links will use a pre-shared key that will only be distributed to ARKnet admins and installed on Uplink Routers. Connections to the backhaul links will be logged and monitored to alert admins to any security issues with these long-range links.

Each site will provide Ethernet and wireless access for network clients. Ethernet access will depend on physical site security, while wireless access will have a simple password common to all of the sites.

#### 4.5 Communications Architecture

ARKnet is based on each site have a single local authoritative router, which mediates connectivity between all of the local clients and the rest of the ARKnet network. As new portions of the network come online, they will each inject advertisements for their site into the network backbone (using the industry standard OSPF protocol) and the network will dynamically add the new site into the network. Should any sites happen to have connectivity to the Internet or networks maintained by other agencies, routes to these networks will also be advertised to the rest of the ARKnet.

The Deployment is using the minimum of two client sites and one hub site as a proof of concept, but is designed to allow for several interlinked hub sites supporting a large number of client sites. Custom configuration for each site will involve configuring a new Uplink Router to be deployed at the site and adding new resource records for the new site to the EOC server.

The network addresses used for every router and host on the ARKnet will be allocated from the 10.66.0.0/16 private address space, which permits ARKnet to use these 65535 IP addresses internally without the licensing requirements needed to use public IP addresses.

The local domain name used is **cupark.net**, which is not a valid domain name on the public Internet. This is done to ensure that no dependencies for ARKnet services "leak" onto the Internet and that ARKnet will continue to function fully while being completely disconnected from the Internet.

## **4.6 Performance**

Quantitative performance measurements are a major goal of the Deployment ARKnet, and will help guide the development of further applications using the ARKnet infrastructure.

Network performance will be measured both on a periodic basis using active testing methods such as iperf and copying large test sets of data, and measured continuously in a passive way, where individual network nodes will be queried for their health and status.

## 5 System Design

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### 5.1 Overview of Subsystems

The system is divided into the following discrete subsystems:

1. Wi-Fi Subsystem, Sector Site
2. Wi-Fi Subsystem, Client Sites
3. Application Support

Each subsystem will be required to enable at least one requirement as identified in the Functional Requirements Document. The mapping of subsystems to Requirements is as follows:

### 5.2 Requirements

REQ#	Description	Sector Sites	Client Sites	App Support
1.	2.2.2 The Deployment will establish wireless network connectivity between several sites in Cupertino	✓	✓	
2.	3.1 Network will interface with one or more ISPs.			✓
3.	3.2.1 Accessibility (Security) <ul style="list-style-type: none"> <li>• Access to Sector Site will be limited...</li> </ul>	✓		
4.	3.2.1 Accessibility (Security) <ul style="list-style-type: none"> <li>• Access to Client Sites will be by wired to local routers or switches, or password-protected wireless access points.</li> </ul>		✓	
5.	3.2.2 Physical Security, Sector Sites <ul style="list-style-type: none"> <li>• Network gear must be installed in a manner that limits contact by anyone with authorized access.</li> <li>• The antenna site should be adequately marked indicating active radio transmissions in operation.</li> <li>• Site access will be managed by the site's facilities staff.</li> </ul>	✓	✓	
6.	3.2.2 Physical Security, Field <ul style="list-style-type: none"> <li>• Network gear must be installed on or near the ARK in a manner that prevents access by the general public.</li> <li>• Critical network equipment, servers, and power control systems will be located inside the ARK in a secured designated area.</li> </ul>		✓	
7.	3.2.2 Physical Security, City Hall <ul style="list-style-type: none"> <li>• Network gear must be installed on the City Hall roof in a manner that prevents contact by employees.</li> <li>• Access control to the roof is managed by the City Staff and designated Project Staff.</li> </ul>		✓	
8.	3.2.3 In General, all ARKnet applications will require a logon and password for access. However, this application will be reviewed on a case by case basis and implemented based on the requirements of the application.		✓	✓
9.	3.2.4 Data will be protected from casual and unauthorized access. File Shares will be assigned by account and/or will be password protected. Application Databases will be accessible only by the calling application or DBAs.	✓	✓	✓
10.	3.2.5 Access to Network Gear: <ul style="list-style-type: none"> <li>• All ARKs are inherently locked up when not in use.</li> <li>• Additional requirements for securing equipment to avoid</li> </ul>		✓	

REQ#	Description	Sector Sites	Client Sites	App Support
	tampering will be developed as part of the implementation.			
11.	3.7 System Availability <ul style="list-style-type: none"> <li>The network will be 'always on' and available 24x7.</li> <li>Network components at all sites must be continuously available for operation.</li> </ul>	✓	✓	✓
12.	3.9 Performance, Throughput <ul style="list-style-type: none"> <li>10Mbps between EOC and ARK</li> </ul>	✓	✓	
13.	3.9 Performance, Latency <ul style="list-style-type: none"> <li>100ms</li> </ul>	✓	✓	
14.	3.10 Capacity, Voice Messages <ul style="list-style-type: none"> <li>~200 / hour</li> </ul>	✓	✓	✓
15.	3.10 Capacity, Digital Messages <ul style="list-style-type: none"> <li>~10,000 / hour</li> </ul>	✓	✓	✓
16.	3.10 Capacity, Images (pictures, videos) <ul style="list-style-type: none"> <li>1000MB/hour (500 pictures/hour)</li> </ul>	✓	✓	✓

### 5.3 Database Design

There is no custom database required for this Deployment. Application databases will be implemented as part of the relevant application installation process.

### 5.4 Data Conversions

There is no data conversions required for this Deployment.

### 5.5 Interface Design

#### 5.5.1 Application Program Interfaces

There is no custom application work required for this Deployment. APIs will use the standard methods built into the COTS applications that the Deployment will deploy.

#### 5.5.2 User Interfaces

There is no custom User Interface work required for this Deployment. All UIs will be based on the standard UI as built into the COTS applications that the Deployment will deploy.

### 5.6 Hardware Design

Hardware is divided the following categories:

1. Electrical/Electronic. Includes purchasing of the necessary RF, Network, and power equipment.
2. Mechanical / Structural. Includes purchasing, assembling, modifying, and/or mounting items such as masts, mechanical connectors, and struts using the necessary mounting hardware.
3. Fabricated. Includes designing, documenting, and building the necessary cables or custom fixtures needed to support the hardware installation.
4. Configuration. Includes defining, documenting, and creating the necessary setups, or scripts to perform configuration automatically.

**5.6.1 Electrical / Electronic**

**Content moved to the BOM Doc.**

The following is the Bill of Materials required to support Electrical/Electronic hardware category.

Site	Item, Description	Qty	U/E	Unit price	Price	Supplier	Notes
Total, excludes Tax, S&H							

**5.6.2 Mechanical/Structural**

The following is the Bill of Materials required to support the mechanical/ structural hardware category.

Site	Item, Description	Qty	U/E	Unit price	Ext Price	Supplier	Notes
Total, excludes Tax, S&H							

**5.6.1 Fabricated**

The following is the Bill of Materials required to support the fabricated hardware category.

Site	Item, Description	Qty	U/E	Unit price	Price	Supplier	Notes
Total, excludes Tax, S&H							

## 6 Operational Scenarios

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### 6.1 Use Cases – **INCOMPLETE DESCRIPTION**

#### 6.1.1 Field Client Site

From the Field, users will organize at the ARKs to deploy into the surrounding neighborhoods to provide damage assessment surveys, first aid, search and rescue, minor fire suppression, and community outreach. It is expected that these responders will handle any situation that they encounter **within their means**.

Information passed from the ARKs to the EOC could include, but not limited to:

1. ARK activation status
2. Staffing levels
3. Damage Assessment summaries

Requests submitted by the ARKs to the EOC could include, but not limited to:

1. Staffing assistance; may need to rebalance resources from one ARK to another.
2. Logistics requests.
3. Material replenishment and/or forecasts of consumption, such as fuel, supplies, etc.
4. Medical assistance or transport to a hospital.
5. Fire Department assistance for structural fires or heavy search and rescue

#### 6.1.2 EOC

The City staff will activate the EOC with the intent of providing strategic direction for the overall response. The EOC learns about what is going on in the City by receiving information from Cupertino DPW, County Fire, the Sheriff's Office, CCC, other agencies, special districts, and residents.

Information passed from the EOC to the ARKs could include, but is not limited to:

1. Information to be shared with the community
2. Responses to resource requests

Requests passed from the EOC to the ARKs could include, but is not limited to:

1. Local Status
2. Resource redeployments

ARKnet will enable the exchange of information in the following ways:

1. Access to and ability to update reference documents and knowledge databases from any site connected to ARKnet.
2. Enables movement of large volumes of low-priority information without occupying valuable time on voice radio channels.
3. Enables richer communication channels including pictures, videos, private voice conversations, and chat rooms.

## 7 Glossary

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ARK	Storages containers located throughout the city that contains emergency supplies to be used by CCC responders in the event of an emergency.
CARES	Cupertino Amateur Radio Emergency Service, ARES/RACES organization supporting the City of Cupertino
CCC	Cupertino Citizens Corps; the umbrella organization that provides coordination of CARES, CERT, MRC and Block Leaders.
CERT	Community Emergency Response Team. Community Emergency Response Team; trained in light search and rescue, disaster medicine, fire suppression and Help Desk.
COTS	Commercial Off the Shelf; describes software or hardware products that are ready-made and available for sale to the general public.
DPW	Department of Public Works; a city department charged with maintenance of city facilities, parks, and roads.
EOC	Central command and control facility responsible for carrying out the principles of emergency preparedness and emergency management.
Internet	A global system of interconnected computer networks that uses the standard Internet protocol suite (TCP/IP) to link several billion devices <u>worldwide</u> .
Intranet	A computer network that uses Internet Protocol technology to share information, operational systems, or computing services <u>within an organization</u> .
ISP	Internet Service Provider; typically refers to a wired infrastructure.
MRC	Medical Reserve Corps. Volunteers that supplement the existing emergency and public health resources.
VoIP	Voice over Internet Protocol. a group of technologies for delivering voice communications and multimedia sessions over Internet Protocol (IP) networks.
WISP	Wireless Internet Service Provider