ARKnet Pilot
System Design Document

Cupertino Citizens Corps

December 2014
Revision 1.2, **FINAL**

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Revision

Rev	Date	Comments
1.0	12/03/2014	First Pass, passed to W6KWF
1.1	12/03/2014	Added missing sections except networking BOM
1.2	12/04/2014	All feedback incorporated. Final, version 1.2

1 Introduction

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. The SDD is used to document both high-level system design and low-level detailed design specifications.

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.

The SDD's intended audience is the project manager, project team, and development team. 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

2.1 Overview

The ARKnet Pilot Project will deploy an emergency wireless network to 3 sites in Cupertino as a feasibility test before recommending full deployment to all ARK sites in the city. Ultimately, this network would be used during emergencies by the Cupertino Citizen Corp and other City staff as required.

2.1.1 Purpose, Objectives

This document is a high level description of ARKnet architecture. It summarizes the contents of the document.

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.

2.1.2 Scope of Project

All 6 ARKS, the EOC, and any other designated City or Served Agency sites, would be able to connect to this city-owned emergency network. A central wireless backbone site would be established at Montebello Apartments and/or the Cypress Hotel. Client sites (ARKs, others) would connect to this backbone using exiting 802.11 wireless networking equipment and protocols.

Once the network is established, the following applications could be enabled (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 the network 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.
3. City emergency responders and staff at City sites where the network is deployed (Quinlan Center, Service Center, Traffic Department, etc.).

The scope of this project is a Pilot that would demonstrate application items 1 through 4 above for these three sites:

1. Cupertino EOC

2. Hyde Ark, Hyde Middle School
3. Montebello Apartments (current location of the CARES 440 repeater)

2.2 Assumptions, Constraints, Risks

2.2.1 Assumptions

The following assumptions are made about the ARKnet Pilot 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 unavailable or limited.
4. The Network operates under FCC Type 15 rules (no radio or operator license required).
5. All equipment is Commercial off the Shelf. Other than configuration, 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 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 we will need to look at alternate backbone (high level access) sites.
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

3.1 Goals and Guidelines

3.1.1 Goals

The primary goal of the solution is to design and 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.

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 environment.
3. Scalability. The solution will be implemented to ensure that we can deploy additional sites without impacting performance for the current 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 platform.
5. Standard Protocols. The solution will use IEEE and ANSI standard network protocols at all times. 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 to occur.
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 without user intervention.

3.2 Performance Engineering

The performance requirements listed in the functional requirements document, and how they will be attained, are:

Performance attribute	**Requirement**	**Means to accomplish in the design**
Response time for queries and updates	N/A for the pilot	
Throughput	**REQ#11:** 10Mbps between EOC and ARK	Testing will use the iperf tool to measure sustained throughput over a minute of testing
Latency	**REQ#12:** 100ms	Testing will use the ping and mtr network diagnostic tools
Expected volume of data	N/A for the pilot	
Expected volume of user activity	N/A for the pilot	

4 System Architecture and Architecture Design

This section outlines the system and hardware architecture design of the system that is being built.

4.1 Overview

ARKnet is a collection of hardware components and 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 (iphones, iPads Tablets, PCs, netbooks, etc.) can then access applications and data that reside both locally as well as at remote locations that reside on application servers that are also connected to the network.

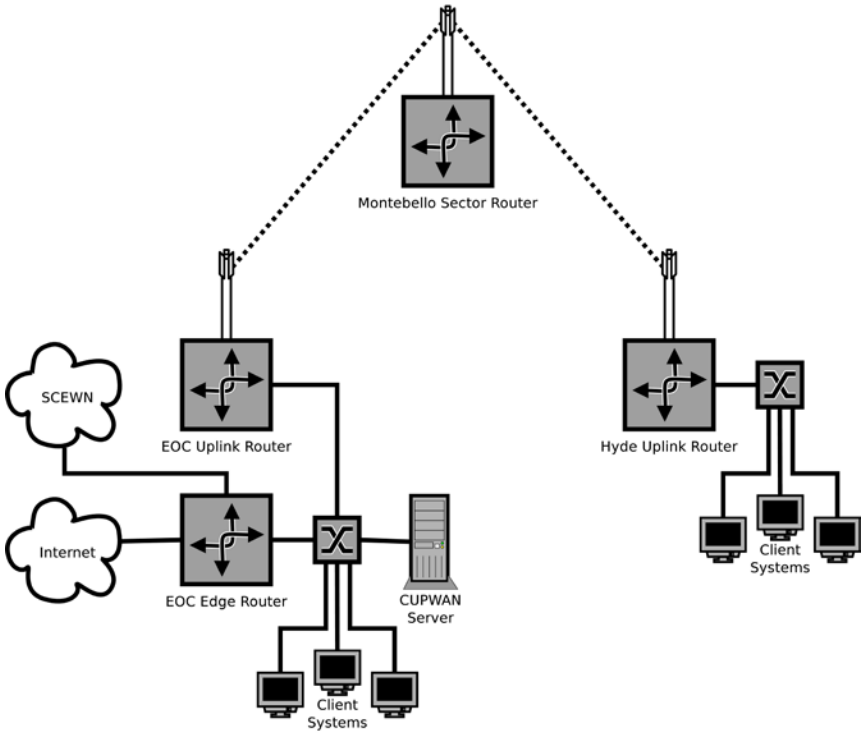
For instance, the following applications are planned to be deployed on ARKnet as part of the Pilot:

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 elsewhere on at the local network, or at a remote site.
2. File sharing. FTP (File Transfer Protocol) is one method to transfer large files, such 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.
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 be running locally on the ARKnet and allow users to send direct messages to other specific 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 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

The Hardware architecture is described in the following views:

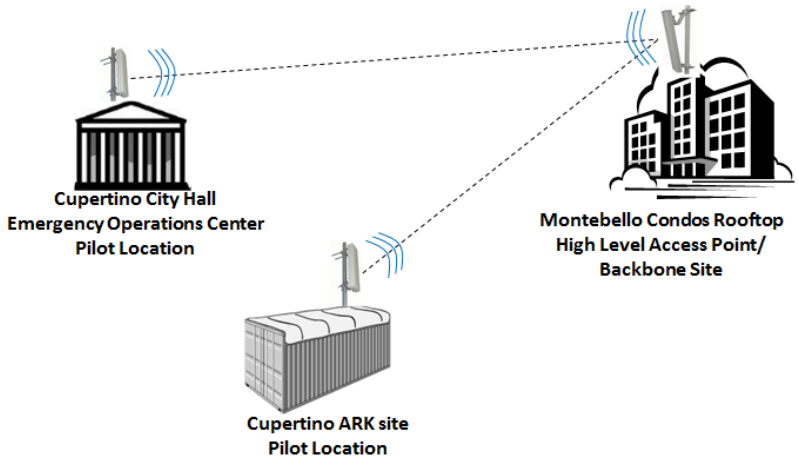
4.2.1 Network Architecture



4.2.2 Sites Architecture

Network hardware will be deployed to three sites:

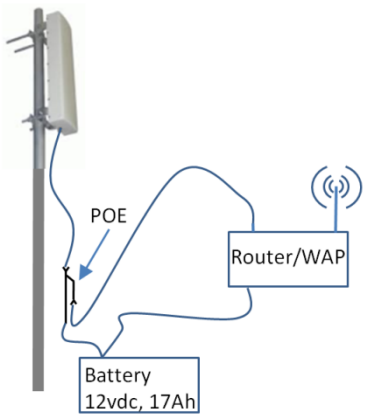
1. Montebello Condos: hosts the main relay site for the pilot
2. Cupertino City Hall: a client site.
3. Hyde Middle School ARK: a client site.



4.2.3 ARK Site Architecture

The ARK Network hardware consists of the following:

1. MicroTik SXT 5ac access point.
2. POE adaptor; power over Ethernet. Connects the access point to the Battery and the Local Wireless Router.
3. Mikrotik RB951Ui WiFi Access Point. Creates a WiFi hotspot for local wireless and wired local users to the access point.
4. Battery: Pilot: Deep cycle, or Gel Cell.



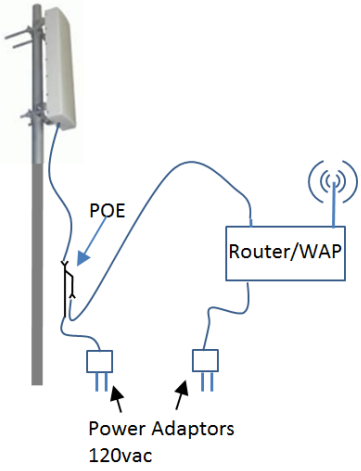
The configuration requirements are:

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

4.2.4 EOC Site Architecture

The EOC Network hardware consists of the following:

1. MicroTik SXT 5ac access point.
2. POE adaptor; power over Ethernet. Connects the access point to the Battery and the Local Wireless Router.
3. Mikrotik RB951Ui WiFi Access Point. Creates a WiFi hotspot for local wireless and wired local users to the access point.
4. Desktop computer configured as the ARKnet server
5. Edge router to provide connectivity between ARKnet and the Internet.
6. Power Adaptors: one each for the Router, Access Point, Edge router, and server.



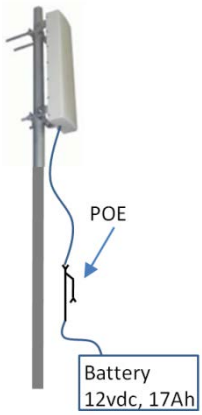
The configuration requirements are:

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

4.2.5 Montebello Condos Site Architecture

The Backbone Network hardware consists of the following:

1. MicroTik SXT SA5ac wide beam width sector antenna.
2. POE adaptor; power over Ethernet. Connects the sector antenna to the Battery.
3. Battery: Pilot: Since we will deploy to the same site as the W6TDM repeater, we will plug into the Repeater power and battery backup system.



The configuration requirements are:

1. Microtik; link, local router

4.2.6 Security Hardware Architecture

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

1. Montebello Condos: Equipment will be installed on the roof, a controlled access space only available to Condo maintenance and security, and visitors at the discretion of the Condo Management. No design action is required to secure this 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. Hyde Middle School ARK: a client site. Equipment will be installed on a post, and secured to the ARK exterior. The placement of this equipment for the Pilot will need review and approval from CCC to ensue any enclosure penetrations proposed are understood and the risks from a penetration is properly mitigated.

4.3 Software Architecture

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

The following software is required to support the Pilot:

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.	http://www.mikrotik.com/software
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,	http://www.asterisk.org/

Network Apps	Description	Reference
	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.	
FTP (vsftpd)	**vsftpd**, (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.	https://security.appspot.com/vsftpd.html
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.	http://httpd.apache.org/
Samba	An open-source SMB/CIFS server to provide file sharing between Windows and OSX clients. No additional software needed on client systems	http://www.samba.org/
BIND	Industry standard DNS server to provide local domain name resolution to all clients on the ARKnet.	http://www.isc.org/downloads/bind/
Ngircd	An open-source Internet Relay Chat (IRC) server, which is an open and well supported standard for Internet chat rooms.	http://ngircd.barton.de/
Cacti	A web-based network monitoring tool used to continually collect telemetry about the network and present it to admins for monitoring	http://www.cacti.net/

User Apps	Description	Reference
Filezilla Client	FTP client for Windows systems	https://filezilla-project.org/
FTP Client Pro	FTP Client, runs on Apple	https://itunes.apple.com/us/app/ftp-client-pro/id425341262?mt=8
Pidgin	A free Peer to Peer chat program which lets you log in to accounts on multiple chat networks simultaneously.	https://www.pidgin.im/
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.	https://www.apple.com/support/bonjour/
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

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

The 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 pilot 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 cupertino.lan, 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 pilot 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

5.1 Overview of Subsystems

The system is divided into the following discrete subsystems:

1. WiFi Subsystem, Backbone Site
2. WiFi Subsystem, EOC Site
3. WiFi Subsystem, Field Site
4. Network Subsystem, Field Sites

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	S1: WiFi, Backbone	S2: WiFi, EOC	S3: WiFi, Field	S4:Field Network
1. The Pilot will establish wireless network connectivity between three sites in Cupertino.	✓	✓	✓	
2. Network will interface with one or more ISPs.		✓		
3. Network access must be controlled at all locations to ensure the privacy and safety of collected data, and the integrity of the network infrastructure.	✓	✓	✓	
4. Accessibility (Security) ARKnet Pilot will be accessible by the following users: • Pilot Project Team. • Select EOC Staff.	✓			
5. Physical Security, Montebello • Network gear must be installed on the Condos roof in a manner that prevents contact by residents. • The antenna site should be adequately marked indicating active radio transmissions in operation. • Access control to the roof should continue to be managed by the Condo Staff.	✓			
6. Physical Security, EOC • Network gear must be installed on the City Hall roof in a manner that prevents contact by employees. • Access control to the roof is managed by the City Staff and designated Project Staff.		✓		
7. Physical Security, ARK • Network gear must be installed on or near the ARK in a manner that prevents access by students and the general public.			✓	
8. System Availability, Montebello • Network components must be continuously operational.	✓			
9. System Availability, EOC • Network components must be continuously operational.		✓		✓

REQ# Description	S1: WiFi, Backbone	S2: WiFi, EOC	S3: WiFi, Field	S4:Field Network
10. System Availability, ARK • Network components must be operational during test.			✓	✓
11. Performance, Throughput • 10Mbps between EOC and ARK	✓	✓	✓	
12. Performance, Latency • 100ms	✓	✓	✓	
13. Capacity, Voice Messages • ~200 / hour	✓	✓	✓	✓
14. Capacity, Digital Messages • ~10,000 / hour	✓	✓	✓	✓
15. Capacity, Images (pictures, videos) • 1000MB/hour (500 pictures/hour)	✓	✓	✓	

5.3 Database Design

There is no custom database required for this Pilot. 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 Pilot.

5.5 Interface Design

5.5.1 Application Program Interfaces

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

5.5.2 User Interfaces

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

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
EOC	ARKnet Server	1	ea	$0.00	$0.00	PhirePhly Design	On loan for ARKnet pilot
EOC	RB2011UiAS-RM	1	ea	$103.00	$103.00	Streakwave	Edge Router
EOC	RB951Ui	1	ea	$49.00	$49.00	Streakwave	Site access points
Hyde	RB951Ui	1	ea	$49.00	$49.00	Streakwave	Site access points
EOC	SXT 5 ac	1	ea	$93.00	$93.00	Streakwave	Uplink Router
Hyde	SXT 5 ac	1	ea	$93.00	$93.00	Streakwave	Uplink Router
Condos	SXT SA5 ac	1	ea	$98.00	$98.00	Streakwave	Sector Router
	Total, excludes Tax, S&H				$485.00		

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
All	7 Terminal Grounding bar	3	ea	$5.00	$15.00	Home Depot	
All	TP-ESP-1000-POE Surge Supress	3	ea	$23.95	$71.85	streakwave.com	
All	Power strip	3	ea	$10.00	$30.00	Home Depot	
All	6AWG Grounding cable (ft)	30	ft	$0.95	$28.50	Home Depot	
All	Black UV Zipties	0.2	ea	$10.00	$2.00	Home Depot	
All	Assorted hardware	1	ea	$20.00	$20.00		
Condos	Tripod PYLE-PRO PSTND2 - 6.5 ft.	1	ea	$30.00	$30.00	Amazon	Antenna Mast Support
Condos	IMC Rigid Conduit 1.5" x 10'	1	ea	$22.00	$22.00	Home Depot	Antenna Mast, need 6ft
Condos	Cinder Blocks	2	ea	$0.00	$0.00	ServiceCenter	Antenna Mast Tripod Support

Site	Item, Description	Qty	U/E	Unit price	Ext Price	Supplier	Notes
EOC	1.5" EMT Conduit (10')	1	ea	$12.70	12.70	Home Depot	Antenna Mast
EOC	Channel Universal Pipe Strap, 2 In	1	ea	$18.00	$18.00	Home Depot	Mounts the EOC mast section to the exiting SCEWN Mast mount
Hyde	12" Sq stepping stone	1	ea	$0.98	$0.98	Home Depot	Antenna Base
Hyde	IMC Rigid Conduit 1.5" x 10'	2	ea	$22.00	$44.00	Home Depot	Antenna Mast
Hyde	2 hole 1.5" Conduit Strap	2	ea	$0.73	$1.46	Home Depot	
Hyde	1.5" EMT service entrance	1	ea	$8.77	$8.77	Home Depot	
Hyde	1.5" EMT threaded connector	1	ea	$1.38	$1.38	Home Depot	
Hyde	0.5" Grounding rod (8')	1	ea	$11.00	$11.00	Home Depot	
Hyde	0.5" Grounding rod clamp	1	ea	$4.00	$4.00	Home Depot	
Hyde	3/4" Plywood backplate	1	ea	$28.68	$28.68	Home Depot	Mounting board for Network equipment
Hyde	2-1/2 inch Steel Conduit Hanger	2	Ea	$9.66	$19.32	Home Depot	ARK Mount antenna mast
	Total, excludes Tax, S&H				$369.64		

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
Condos	CAT-5	100	ft	$0.10	$10.00	Team	Custom length CAT-5 cable to Power Supply
Hyde	CAT-5	30	ft	$0.10	$3.00	Team	Custom length CAT-5 cable to Power Supply
EOC	CAT-5	100	ft	$0.10	$10.00	Team	Custom length CAT-5 cable to Power Supply
	Total, excludes Tax, S&H				$23.00		

6 Operational Scenarios

6.1 Use Cases

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

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 worldwide.
Intranet	A computer network that uses Internet Protocol technology to share information, operational systems, or computing services within an organization.
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