
ARKnet Deployment Functional Requirements Document

Cupertino Citizens Corps

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Revision

Rev	Date	Comments
0.1	05/18/2015	First Pass, ready for Team Review
0.2	06/06/15	With team feedback, first review
0.3	07/15/15	With feedback, second review
1.1	01/15/16	Refined list of client sites

1 General

1.1 Project Description

The ARKnet Deployment Project builds on the ARKnet Pilot that was presented and approved in January 2015. This project will deploy an emergency wireless network that connects the EOC with the 7 Cupertino Citizen Corps (CCC) ARK sites in Cupertino, essentially establishing the *Cupertino Emergency Internet*.

1.1.1 Background

Cupertino has 7 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 to name a few – is critical to the ensuring the success of the response. This information, when shared with the EOC, can also give the city an *over-the-shoulder* look at what is happening in the field.

Amateur Radio continues to be the emergency communications means of last resort for exchanging information between the EOC and the field (when all else fails...). This will not change. However, new technologies and products are now available that can augment the information management process, thereby allowing our field responders to readily share more information with the City and other City responders with the goal of accelerating decision-making and the recovery.

1.1.2 Purpose, Objectives

The project's overall objectives are:

- Deploy a wireless network to CCC locations throughout Cupertino.
- Identify and deploy a select set of network-wide applications and services.
- Work with CCC to map this capability into the current operational response processes.

1.1.3 Assumptions and Constraints

Assumptions are future situations, beyond the control of the project, whose outcomes influence the success of a project. The following assumptions are made for the ARKnet Deployment:

1. Existing *Commercial off the Shelf* network technology is sufficient to provide connectivity to all ARKs.
2. We have access to sufficient high level locations that can host network access points (sector sites) and have a clear RF line of sight path to the planned Deployment sites.
3. The choice of the 5 GHz band limits our exposure to other Wi-Fi interference in the bay area.
4. With the deployment of ARKnet, CCC Field responders will incorporate this capability into their ICS processes.

5. ARKnet is not intended to be a WISP for Wi-Fi access by the general public.

Constraints are conditions outside the control of the project that limit the design alternatives. The following constraints exist for the ARKnet Deployment:

1. There are no city-owned locations that make for ideal network access points (backbone sites).
2. Sites do exist within the city; access will have to be negotiated with site owners and managers.

1.2 Points of Contact

The following will be involved with this project

- Project Team
 - Jim Oberhofer, Project Manager
 - Kenneth Finnegan, Technical project lead
 - Allan Gontang, Technical Resource
 - Marcel Stieber, Technical Resource
 - Judy Halchin, ARK Data Automation Lead
 - Skip Stevens, Technical Resource
 - Ian Sidle, Technical Resource
- User contacts
 - Ken Erickson, Citizen Corps Coordinator
- City Sponsors
 - Carol Atwood, Cupertino City Director of OES, Recreation and Community Services
- City Resources
 - Pete Coglianesse, City Channel Manager
 - Rick Kitson, Cupertino City Director, Communications

1.3 Document References

The following documents were referenced in developing this FRD.

1. *“Proposal, Cupertino Emergency Wireless Intranet Deployment”*, 7 November 2014
2. *“ARKnet Pilot, Functional Requirements Document”*, November 2014
3. *“ARKnet Pilot, System Design Document”*, December 2014
4. *“ARKnet Pilot, Summary and Recommendation”*, January 2015

2 Functional Requirements

This section describes the core functionality of the ARKnet Deployment.

2.1 Data Requirements

The ARKnet Deployment is a network implementation and will not require a data model as part of its implementation.

However, ARKnet will monitor and collect network performance and health information, to be managed on the network management servers.

2.2 Functional Process Requirements

2.2.1 In General

ARKnet essentially creates the City's *Emergency Intranet*.

The purpose of any network is to enable the sharing of information between users who are connected to the network. In the case of ARKnet, the primary users are those involved with emergency management and the response.

2.2.2 Deployment Sites

REQ#01: The Deployment will establish wireless network connectivity between several sites in Cupertino:

1. Sector Sites
 - a. Cupertino Civic Center, Building 3
 - b. Lehigh Permanente Cement Plant
2. Field Client Sites
 - a. DeAnza ARK
 - b. Regnart Elementary ARK
 - c. Hyde Middle School ARK
 - d. Lawson Middle School ARK
 - e. Garden Gate Elementary ARK
 - f. Cupertino Medical Center ARK
 - g. Cupertino Fire Station 71
 - h. Seven Springs Fire Station 72
 - i. Monta Vista Fire Station 77
 - j. Cupertino Sanitary District Office
3. City Client Sites
 - a. EOC
 - b. Service Center
 - c. Senior Center
 - d. Quinlan
 - e. Traffic Ops
 - f. OES Communications Van
4. Other Sites
 - a. Field Stations
 - b. W6TDM Repeater Site
 - c. Remote system maintenance access sites

2.2.3 Sector Sites

These are one or more central Wi-Fi nodes that provide network access to all remote site access points.

Sector Sites require line of sight with all Client sites. It is anticipated that more than one Sector Site will be required to ensure adequate coverage over the city.

2.2.4 Field Client Sites

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

2.2.5 City Client Sites

Emergency Operations Center

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. Replies 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.

Service Center

The Service Center was identified as an initial City Site to be brought up. Along with network access during an emergency, there is a need for on-going daily operational access.

Information flows between the Service Center and the EOC have not been characterized.

Communications Van

The Cupertino Comm Van will have the capability to access ARKnet as part of its role in emergency communications management.

Comm Van interaction with ARKnet will include, but not limited to:

1. Support of the field users
2. Network Administration tasks

2.2.6 Other Sites

ARKnet will support portable network access from portable stations. Portable Client site capability will be developed that allows a Portable Sites to be set up in any location within the city and access ARKnet.

Applications for such a capability include, but not limited to:

1. Network "Phone Booth"
2. Area surveillance with video feeds

3 Operational Requirements

Operational requirements describe the characteristics of the solution.

3.1 Interfaces to External Systems

REQ#02: The ARKnet Deployment will interface with one or more ISPs. At the City's discretion, the following internet services should be considered:

1. Commercial ISP. The City of Cupertino will provide an interconnect between their ISP and ARKnet.
2. InfraLink. A commercial Bay Area-wide emergency wireless network to which the City of Cupertino subscribes (off-shoot of SCEWN).

3.2 Security

The ARKnet Deployment will implement specific aspects of network security as described here.

3.2.1 Accessibility

Access will be controlled at all site locations to ensure the privacy and safety of all collected data, and the integrity of the network infrastructure.

The ARKnet environment is made up of two levels of access:

1. Sector Site Router Access. This refers to the connectivity to one or more Sector Site network equipment.
2. Client Site Network Access. This refers to user connectivity to Client Site network equipment and their ability to access the network applications to perform their work.

REQ#03: Network access to Sector Site Routers will be limited as follows:

1. Client Site network connections
2. Other Sector network connections
3. ARKnet administrators

REQ#04: Network access to Client Sites will be by either wired connection to site routers or switches, or wireless access points (WAPs). All wireless network access will be password protected. Access to the Client Site network will be for the following users:

1. Field Responders at the ARKs
2. City Site staff (EOC, Service Center)
3. ARKnet administrators

Failure to ensure adequate access security may result in the following:

1. Inadvertent information disclosure to the public and media.
2. Improper access to and manipulation of data and capabilities by unqualified users.
3. Loss of data due to unqualified users.
4. System overload due to unauthorized or excessive access
5. Improper or inappropriate use of the network that could portray the city in a bad light.

3.2.2 Physical Security

The physical security requirements for each site are:

Site	Requirement
Sector Sites	<p>REQ#05: Network gear must be installed in a manner that limits contact by anyone with authorized access.</p> <p>The antenna site should be adequately marked indicating active radio transmissions in operation.</p> <p>Site access will be managed by the site's facilities staff.</p>
Field Client Sites	<p>REQ#06: Network gear must be installed on or near the ARK in a manner that prevents access by the general public.</p> <p>Critical network equipment, servers, and power control systems will be located inside the ARK in a secured designated area.</p>
EOC	<p>REQ#07: Network gear must be installed on the City Hall roof in a manner that prevents contact by employees.</p> <p>Access control to the roof is managed by the City Staff and designated Project Staff.</p>

3.2.3 Access to Applications

REQ#08: 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.

3.2.4 Access to Event Data

REQ#09: 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.

3.2.5 Access to Network Gear

REQ#10: All ARKs are inherently locked up when not in use. Additional requirements for securing equipment to avoid tampering will be developed as part of the implementation.

3.3 Audit Trail

No requirements specified for the Deployment.

3.4 Data Currency

Data currency is a measure of the timeliness of data updates across the network.

No requirements specified for the Deployment.

3.5 Reliability

Reliability is the probability that the system will be able to process work correctly and completely without being aborted.

The following reliability metrics will be implemented for the Deployment and gathered during Operation. No requirements are being implemented at this time.

- Mean Time between Failure: the number of time units the system is operable before the first failure occurs.
- Mean Time to Failure: computed as the number of time units before the system is operable divided by the number of failures during the time period.
- Mean Time to Repair: computed as the number of time units required to perform system repair divided by the number of repairs during the time period.

3.6 Recoverability

Recoverability, or resiliency, is the ability to restore function and data in the event of a failure.

No requirements specified for the Deployment. This topic will be reviewed post-deployment.

3.7 System Availability

System availability is the time when the solution must be available for use.

REQ#11: The network will be ‘always on’ and available 24x7. Network components at all sites must be continuously available for operation.

3.8 Fault Tolerance

Fault tolerance is the ability to remain partially operational during a failure.

No requirements specified for the Deployment. This topic will be reviewed post-deployment.

3.9 Performance

Network performance requirements are as follows:

Performance attribute	Requirement
Throughput	REQ#12: 5Mbps between EOC and ARK
Latency	REQ#13: 100ms

3.10 Capacity

The current information capacity is described here in terms of planned applications:

Information capacity	Current ¹	Requirement
Messages, voice (complexity low)	~20 msgs / hr	REQ#14: ~200/hour
Messages, digital (complexity low)	~20 msgs / hr	REQ#15: ~10,000/hour

¹ Current refers to the current Voice and Packet message rates.

Information capacity	Current¹	Requirement
Images (pictures, videos)	0 Mb / hour	REQ#16: 1000MB/hour (500 pictures/hour)

3.11 Data Retention

Describe the length of time the data must be retained.

Messages are maintained in the originating and receiving applications. No explicit message archiving will be performed by the ARKnet solution.

4 Requirements Traceability Matrix

The requirements traceability matrix (RTM) provides a method for tracking the functional requirements and their implementation through the development process.

REQ#	Description	Design	Build	Test
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"> Access to Sector Site will be limited... 			
4.	3.2.1 Accessibility (Security) <ul style="list-style-type: none"> Access to Client Sites will be by wired to local routers or switches, or password-protected wireless access points. 			
5.	3.2.2 Physical Security, Sector Sites <ul style="list-style-type: none"> Network gear must be installed in a manner that limits contact by anyone with authorized access. The antenna site should be adequately marked indicating active radio transmissions in operation. Site access will be managed by the site's facilities staff. 			
6.	3.2.2 Physical Security, Field <ul style="list-style-type: none"> Network gear must be installed on or near the ARK in a manner that prevents access by the general public. Critical network equipment, servers, and power control systems will be located inside the ARK in a secured designated area. 			
7.	3.2.2 Physical Security, City Hall <ul style="list-style-type: none"> 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. 			
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"> All ARKs are inherently locked up when not in use. Additional requirements for securing equipment to avoid tampering will be developed as part of the implementation. 			
11.	3.7 System Availability <ul style="list-style-type: none"> The network will be 'always on' and available 24x7. Network components at all sites must be continuously available for operation. 			
12.	3.9 Performance, Throughput <ul style="list-style-type: none"> 10Mbps between EOC and ARK 			
13.	3.9 Performance, Latency <ul style="list-style-type: none"> 100ms 			
14.	3.10 Capacity, Voice Messages <ul style="list-style-type: none"> ~200 / hour 			

REQ#	Description	Design	Build	Test
15.	3.10 Capacity, Digital Messages <ul style="list-style-type: none">• ~10,000 / hour			
16.	3.10 Capacity, Images (pictures, videos) <ul style="list-style-type: none">• 1000MB/hour (500 pictures/hour)			

5 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. Lead organization for ARKnet.
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