ARKnet Pilot
Functional Requirements Document

Cupertino Citizens Corps

November 2014
Revision 1.2, **FINAL**

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Revision

Rev	Date	Comments
1.0	11/20/2014	First Pass, ready for Team Review
1.1	11/21/2014	First Team Review held
1.2	11/24/2014	Final

1 General

1.1 Project Description

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.

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

This Ultimate objective of a full deployment is to support the City's need for an accurate and timely assessment of the situation in the field during an emergency activation.

For this Pilot, the project's objectives are:

- Confirm the feasibility of establishing an emergency wireless network in the City.
- Confirm the operation of all pilot applications and services.
- Develop more detailed real-world network performance metrics allowing us to better evaluate other possible applications and their associated bandwidth.

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 Pilot:

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 (backbone sites) and have a clear RF line of sight path to the planned pilot 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 embrace technology to execute the ICS processes.
5. We complete the Pilot within 2 months of Pilot approval by the City.
6. ARKnet is not intended to be a WISP for 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 Pilot:

1. There are no city-owned locations that make for ideal network access points (backbone sites). These sites exist within the city, and access will have to be negotiated.

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
  - TBD
- User contacts
  - Ken Erickson, Citizen Corps Coordinator
- City Sponsors
  - Carol Atwood, Cupertino City Director of OES, Recreation and Community Services
- City Resources
  - Pete Coglianese, 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 Pilot"*, 7 November 2014

2 Functional Requirements

This section describes the core functionality of the ARKnet Pilot.

2.1 Data Requirements

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

2.2 Functional Process Requirements

State the functional process requirements in a manner that enables the reader to see broad concepts decomposed into layers of increasing detail.

2.2.1 In General

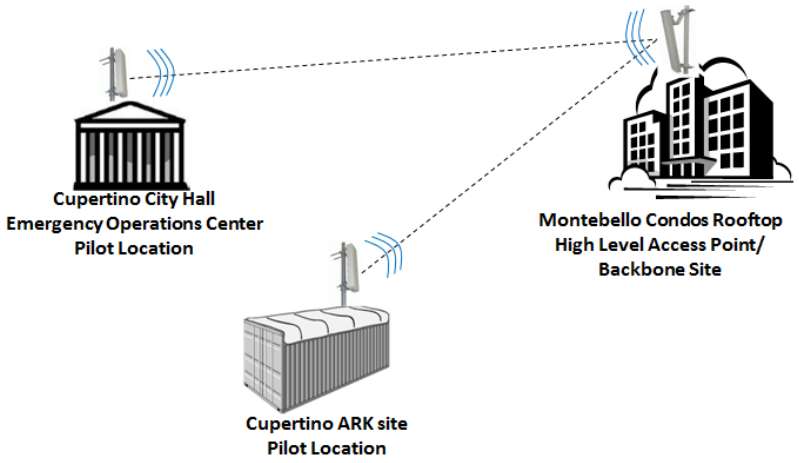
ARKnet essentially creates the City's Emergency *Intranet*.

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 response.

2.2.2 Pilot Sites

REQ#01: The Pilot will establish wireless network connectivity between three sites in Cupertino:

1. High Level Access Point / Backbone. Performs the central link between field locations.
2. EOC Client Site.
3. One Field Client Site.



2.2.3 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

2.2.4 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.

3 Operational Requirements

Operational requirements describe the characteristics of the solution.

3.1 Interfaces to External Systems

REQ#02: The ARKnet pilot 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 emergency wireless network to which the City of Cupertino subscribes.

3.2 Security

The ARKnet pilot will begin to implement certain aspects of Security for the network.

3.2.1 Accessibility

REQ#03: For the Pilot, Network access must be controlled at all locations to ensure the privacy and safety of collected data, and the integrity of the network infrastructure.

REQ#04: The ARKnet Pilot will be accessible by the following users:

3. Pilot Project Team.
4. Select EOC Staff.

While not critical for the Pilot, for the full implementation, failure to ensure adequate access security may result in the following:

1. Inadvertent 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. Improper or inappropriate use of the network that could portray the city in a bad light.

3.2.2 Physical Security

Network equipment will be deployed to 3 sites. The physical security requirements for each site are:

Site	Requirement
Montebello Condos	**REQ#05:** 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 is managed by the Condo Staff.
EOC	**REQ#06:** 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.
Hyde ARK	**REQ#07:** Network gear must be installed on or near

	the ARK in a manner that prevents access by students and the general public.

All other Security requirements will be developed based on the decision to proceed with the full deployment, and will include:

1. Access to specific applications
2. Access to event data
3. Access to network gear
4. Access to the network connectivity from new sites

3.3 Audit Trail

No requirements specified for the pilot.

3.4 Data Currency

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

No requirements specified for the pilot.

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 not be implemented for the Pilot. Instead, the pilot will guide the team in understanding what is possible.

- 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 pilot.

3.7 System Availability

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

For the Pilot, continuous end to end network uptime will not be implemented. The following are requirements for network availability.

Site	**Requirement**
Montebello Condos	**REQ#08:** Network components must be continuously operational.
EOC	**REQ#09:** Network components must be continuously operational.
ARK	**REQ#10:** Network components must be operational during test.

3.8 Fault Tolerance

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

No requirements specified for the pilot.

3.9 Performance

Pilot Network performance requirements are as follows (blanks means not required for the Pilot):

Performance attribute	**Requirement**
Response time for queries and updates	
Throughput	**REQ#11:** 10Mbps between EOC and ARK
Latency	**REQ#12:** 100ms
Expected volume of data	
Expected volume of user activity	

NOTE: The above performance metrics are the bare minimum needed to justify the expense of the ARKnet project.

Should these metrics not be met, ARKnet needs to reconsider the technologies used and begin a search for alternative solutions.

These metrics will be quantitatively measured during the pilot, and the results of these experiments will guide the development of future ARKnet applications.

3.10 Capacity

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

Information capacity	**Current**	**Requirement**
Messages, voice (complexity low)	~20 msgs / hr	**REQ#13:** ~200/hour
Messages, digital (complexity low)	~20 msgs / hr	**REQ#14:** ~10,000/hour
Images (pictures, videos)	0 Mb / hour	**REQ#15:** 1000MB/hour (500 pictures/hour)

3.11 Data Retention

Describe the length of time the data must be retained.

Not relevant for the network implementation.

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. 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.			
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 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