ENCLOSURE FOR SURVEILLANCE HARDWARE

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ABSTRACT
The enclosure for surveillance hardware provided herein protects the hardware from external elements and from damage. The enclosure may be configured for a node of a peer to peer surveillance architecture or other devices, and for mobile or other applications. The enclosure may comprise a sealed component chamber and an adjacent support chamber. The sealed component chamber may enclose the components therein in an air tight manner. The support chamber may comprise an airflow system and thermal conductor which regulates the temperature in the component chamber. The enclosure may be formed from a multilayer material having various protective qualities. A controller may be provided to control operation of the airflow system and thermal conductor in response to changes in temperature.
Fig. 6

Fig. 7
ENCLOSEMENT FOR SURVEILLANCE HARDWARE

CROSS-REFERENCE TO RELATED APPLICATION


BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention
[0003] The invention relates to surveillance system hardware, particularly to an enclosure for protecting and supporting surveillance devices. The invention also relates to enclosures for surveillance nodes used in peer to peer surveillance architectures.
[0004] 2. Related Art
[0005] Surveillance is widely utilized in modern society. Governments, corporations, groups, and even individuals use surveillance to promote public safety and to deter and prevent crime as well as for general monitoring.
[0006] Traditional surveillance systems generally provide audio and video monitoring through an interconnected hierarchical system. For example, a closed-circuit television (CCTV) system may provide video monitoring through a set of closed-circuit cameras connected to a single stand alone aggregation device where the video feeds from the cameras are sent. The captured information may then be viewed through the aggregation device such as on one or more video screens.
[0007] To function properly, a CCTV or other similar traditional system requires a central controller or device which accepts signals from cameras and which may also provide control instructions to the devices. This allows every camera to be monitored and controlled from a single location. However, this introduces a single point of failure in that the failure of the controller would render the entire surveillance system inoperable. Thus, such systems are said to be fragile as a failure of the central controller or the connections between the controller and the cameras either impairs or completely prevents the surveillance system from functioning. This fragility is highly undesirable in a surveillance system especially where public safety is concerned.
[0008] With the introduction of digital and networked devices, surveillance cameras could be connected via standard wired or wireless network connections. This was an improvement in that one or more standard network connections could be used by capture devices rather than a specialized, dedicated, or proprietary video connection. In addition, digital video may be sent across vast distances through digital networks, such as the Internet, which was not possible without great expense using traditional CCTV systems.
[0009] However, network based surveillance systems continue to rely on a centralized controller to function. The video or other surveillance information is still aggregated at the centralized controller which facilitates observation and analysis of the information gathered. Thus, the single point of failure has remained through the transition from traditional CCTV and similar systems to network based surveillance systems.
[0010] It is true that these traditional systems may be configured to have backup central controllers. While these backup systems provide increased reliability they do so at increased cost and offer do not provide a seamless transition from the failed equipment to its associated backup device. In surveillance, any downtime including downtime associated with switching to a backup device is highly undesirable.

[0011] Traditional systems are also difficult to update for new circumstances or environments. For example, moving one or more cameras to a new location or including additional cameras or other collection devices requires installation of at least one connection from each camera or collection device to the central controller. These connections are often physical connections, such as network or coaxial cabling, which are difficult to install especially in existing structures.

[0012] Traditional surveillance devices are also vulnerable to the elements such as excessive temperatures and physical damage. In addition, these devices generally are limited to specific operating environments. Thus, what is desired and disclosed herein is an enclosure for a peer to peer surveillance architecture that encloses and protects surveillance devices while expanding their possible operating environments.

SUMMARY OF THE INVENTION

[0013] A mobile enclosure for surveillance devices or other electronic devices is described herein. In general, the enclosure protects the components of a surveillance device from external elements and damage. The enclosure may regulate the environment surrounding the components and may be designed to isolate vibration and other movements to prevent damage to the components. The enclosure may be configured to have a reduced size well suited for mobile use. The enclosure may include a power system which provides ideal or desired power to the components.

[0014] In one embodiment, the mobile enclosure may comprise a sealed component chamber configured to enclose one or more components, one or more vibration dampening assemblies configured to reduce vibration of the one or more components, and a thermal conductor. The sealed component chamber may be formed from a multilayer material.

[0015] The thermal conductor may have a first portion within the sealed component chamber and a second portion outside the sealed component chamber. The first portion may be configured to cool the sealed component chamber. An airflow system configured to generate at least one airflow within the sealed component chamber may be adjacent the first portion of the thermal conductor. In this manner the airflow system helps to cool the component chamber.

[0016] The thermal conductor may be configured in various ways. For example, the thermal conductor may be a Peltier device. The mobile enclosure may include a controller configured to increase power to the thermal conductor to increase cooling at the first portion of the thermal conductor and configured to decrease power to the thermal conductor to decrease cooling at the first portion of the thermal conductor.

[0017] A thermal dissipater mounted to an exterior portion of the sealed component chamber may also be provided. The thermal dissipater may be connected to the second portion of the thermal conductor to allow the thermal dissipater to transfer heat away from the thermal conductor. It is contemplated that the second portion of the thermal conductor may be embedded into the thermal dissipater.

[0018] One or more direct conduction thermal conductors may also be included. The direct conduction thermal conductors may be in contact with at least one component and the
In this manner, individual components may be directly cooled by the direct conduction thermal conductors.

[0019] The one or more components may be mounted to at least one of the one or more vibration dampening assemblies to isolate the components from vibration. The vibration dampening assemblies may comprise a thermal conductor plate configured to absorb heat from the one or more components. The one or more components may then be mounted to the thermal conductor plate to allow heat to be transferred away from the components and to isolate the components from vibration.

[0020] In another embodiment the mobile enclosure may comprise a thermal conductor having a cooled portion and a heated portion, and a sealed component chamber configured to enclose one or more components. The cooled portion of the thermal conductor may be positioned within the sealed component chamber to cool the component chamber. The component chamber may, but need not always, have an opening to accept the heated portion of the thermal conductor. An airflow system may be located adjacent the thermal conductor to circulate air within the sealed component chamber.

[0021] The mobile enclosure may also comprise a vibration dampening assembly configured to isolate the sealed component chamber from vibration, and a thermal dissipater external to the sealed component chamber. The thermal dissipater may be coupled with the thermal conductor to receive and dissipate heat from the heated portion of the thermal conductor. One or more thermal isolation materials may be located between the component chamber and the thermal dissipater to prevent dissipated heat from reentering the component chamber. A power system having one or more outputs may be used to provide processed power to the one or more components.

[0022] A direct conduction thermal conductor in contact with at least one of the one or more components to directly cool the at least one of the components may also be provided. In addition, one or more external fans mounted to the thermal dissipater may be included. The one or more external fans may generate airflow to break any thermal barrier that forms around the thermal dissipater.

[0023] A method for protecting one or more components within a mobile enclosure is also provided herein. In one embodiment, the method may comprise protecting the one or more components within a component chamber of the mobile enclosure. The component chamber may comprise a multilayer material including one or more layers selected from the group consisting of at least one rigid layer and at least one insulating layer.

[0024] The environment within the component chamber may be controlled. For example, the sealed component chamber may be cooled with a cooled end of a thermal conductor. In addition, at least one airflow may be generated within the component chamber and across at least a portion of the cooled end of the thermal conductor to cool the component chamber.

[0025] It is noted that the heated end of the thermal conductor may be cooled with a thermal dissipater coupled to the heated end. The thermal dissipater external to the sealed component chamber to allow heat from the heated end to be dissipated to the outside environment. At least a portion of the component chamber may be isolated from heat dissipated by the thermal dissipater with one or more thermal isolation materials. This prevents dissipated heat from reentering the component chamber. It is contemplated that an external airflow may be generated at the thermal dissipater to break any thermal barrier that should form around the thermal dissipater.

[0026] The method may also include measuring at least one temperature within the component chamber, increasing power to the thermal conductor to generate additional cooling at the cooled end of the thermal conductor if the at least one temperature is above a first temperature threshold, and decreasing power to the thermal conductor to reduce cooling at the cooled end of the thermal conductor if the at least one temperature is below a second temperature threshold.

[0027] Protection from vibrations or other movement may be provided with the method as well. For instance, the component chamber may be isolated from vibration through one or more external vibration dampening assemblies, which may be used to mount the component chamber to an external surface.

[0028] In addition, at least one of the one or more components may be directly cooled with a direct conduction thermal conductor. To achieve this direct cooling, the direct conduction thermal conductor may be contact with the at least one of the components. The direct conduction thermal conductor may be controlled if desired. For instance, at least one temperature of at least one of the components may be measured. Power to the direct conduction thermal conductor may be increased to generate additional cooling at a cooled end of the direct conduction thermal conductor if the at least one temperature is above a first temperature threshold, and power to the direct conduction thermal conductor may be decreased to reduce cooling at the cooled end of the direct conduction thermal conductor if the at least one temperature is below a second temperature threshold.

[0029] Other systems, methods, features and advantages of the invention will be or will become apparent to one with skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description, be within the scope of the invention, and be protected by the accompanying claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. In the figures, like reference numerals designate corresponding parts throughout the different views.

[0031] FIG. 1 illustrates an exemplary peer to peer surveillance architecture as it may be deployed.

[0032] FIG. 2A is a block diagram illustrating an exemplary peer to peer surveillance architecture where each node is connected through a network.

[0033] FIG. 2B is a block diagram illustrating an exemplary peer to peer surveillance architecture where each node is connected through more than one independent network.

[0034] FIG. 3 is a block diagram illustrating an exemplary node.

[0035] FIG. 4 is a block diagram illustrating an exemplary capture node.

[0036] FIG. 5 is a block diagram illustrating an exemplary viewing node.

[0037] FIG. 6 is a block diagram illustrating an exemplary content storage node.

[0038] FIG. 7 is a block diagram illustrating an exemplary server node.
FIG. 8A is a front perspective view of an exemplary enclosure.

FIG. 8B is a perspective view of an exemplary multilayer material of an enclosure.

FIG. 8C is a rear perspective view of an exemplary enclosure.

FIG. 8D is a cross section view of an exemplary enclosure.

FIG. 9 is a side interior view of an exemplary enclosure.

FIG. 10 is a block diagram illustrating an exemplary control system.

FIG. 11A is a top perspective view of exemplary mobile enclosure.

FIG. 11B is a bottom perspective view of an exemplary mobile enclosure.

FIG. 12A is a perspective view of an exemplary vibration dampener.

FIG. 12B is a perspective view of an exemplary vibration dampening assembly.

FIG. 12C is a perspective view of various exemplary vibration dampening assemblies.

FIG. 13A is a cross section view of an exemplary mobile enclosure.

FIG. 13B is a cross section view of an exemplary mobile enclosure having a support chamber.

FIG. 13C is a perspective view of an exemplary environmental control system.

FIG. 13D is a cross section view of an exemplary environmental control system.

FIG. 13E is a bottom perspective view of exemplary external fans of an environmental control system.

FIG. 14A is a perspective view of an exemplary surveillance device within a mobile enclosure.

FIG. 14B is a side view of an exemplary surveillance device within a mobile enclosure.

FIG. 14C is a perspective view of an exemplary direct conduction thermal conductor within a mobile enclosure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following description, numerous specific details are set forth in order to provide a more thorough description of the present invention. It will be apparent, however, to one skilled in the art, that the present invention may be practiced without these specific details. In other instances, well-known features have not been described in detail so as not to obscure the invention.

Generally, the peer to peer surveillance architecture comprises one or more nodes configured to capture, analyze, store, and present surveillance information. As discussed further below, surveillance information comprises a wide variety of information including video and audio. As used herein, peer to peer means that each node within the surveillance architecture operates such that it is not dependent on (i.e. does not rely on) its peers. This allows the surveillance architecture to have no single point of failure making it extremely robust. The failure of or damage to individual nodes, components, or communication links cannot cause the system to function at less than full capacity when a peer to peer or non-dependent relationship exists between each node and its peers.

The surveillance architecture may be configured to balance requirements and capability. For example, the architecture may be configured for a high or complete redundancy, but may also be configured according to particular requirements based on the necessary functionality, redundancy, and budget considerations.

As will be described further below, the peer to peer surveillance architecture generally comprises one or more capture nodes, server nodes, content storage nodes, and viewing nodes. The capture nodes generally record or capture surveillance information and may be configured to capture specific types of information, such as a camera node which captures video surveillance information. The captured information may be viewed, stored, or analyzed by the other nodes, including other capture nodes. The architecture is able to provide complete redundancy through these nodes, which are configured to function without depending on any other node or any single communication link.

The peer to peer surveillance architecture combines this redundancy with high adaptability and easy deployment, both of which are among the advantages over traditional surveillance systems. This allows collection of surveillance information from a wide range of target areas and is generally made possible through various wireless, cellular, and other network technologies, and allows for stationary and mobile surveillance systems that may be rapidly deployed virtually anywhere as desired. For example, the architecture allows capture nodes to be mounted on buildings, utility poles, in jails, in parks, throughout downtown areas, and intersections even where there are no physical communication links such as network or other cables.

The advantages of the peer to peer surveillance architecture’s reliability and adaptability can be readily seen with regard to public safety. Surveillance enhances public safety and security by allowing police and other security agencies or organizations to monitor citizen safety, specific events, congestion, and even fight graffiti. In addition, surveillance serves as a force multiplier, allowing for example, police or municipalities to expand their coverage without additional officers. Thus, the architecture’s reliability ensures reliable surveillance for these purposes, and its adaptability allows rapid deployment to monitor special events, such as but not limited to sporting events or conventions as well as the ability to quickly and easily remove surveillance once the event is over.

The peer to peer surveillance architecture may also provide analysis of surveillance information. This greatly expands surveillance capabilities without the need for increased personnel as well. For example, the architecture may provide automated license plate recognition, theft detection, and traffic congestion monitoring. The architecture may provide notifications to users or to nodes within the architecture when certain events are present or detected in the surveillance information.

The peer to peer surveillance architecture will now be described with regard to FIGS. 1-7. FIG. 1 illustrates an exemplary embodiment of the surveillance architecture deployed in an urban setting. In one embodiment, the surveillance architecture comprises one or more nodes communicating through a network via one or more communication links.

The network allows communication between one or more nodes to occur and may be any type of communication network or path now known or later develop-
oped. The network 104 may comprise various communication links 108 including wired and wireless links and utilize various communication protocols. In one embodiment, the network 104 is a packet switched network such as an Internet Protocol (IP) network. Any packet based communication protocol, known or later developed, may be used. This includes connection based protocols such as Transmission Control Protocol (TCP), frame relay, and Asynchronous Transfer Mode (ATM). This also includes connectionless protocols such as User Datagram Protocol (UDP). It is contemplated that the network 104, or a portion of it, may also be a circuit switched network in one or more embodiments and that communications between nodes may be encrypted, such as through one or more Virtual Private Networking (VPN) connections to secure communications across the network.

[0067] Each node 100 communicates through the network 104 via one or more communication links 108. The communication links 108 may each represent one or more independent communication links to a network 104 thus allowing each node 100 to have redundant communication links 108. The communication links 108 may be any communication link capable of carrying data now know or later developed. For example, the communication link 108 may comprise electrical, optical, or other cable. The communication link 108 may utilize physical layer topologies such as but not limited to Category 5 or 6, SM or MM fiber, DSL and Long Range Ethernet. The communication link 108 may also be a wireless communication link such as a cellular or other wireless link. Wireless communication links 108 may utilize physical layer topologies such as but not limited to 802.11/b/g, WiMAX, EVDO, GPRS, Long Range Ethernet, and DSL as well as any other wireless protocol capable of carrying data now know or later developed. It is contemplated that these wireless connections or networks may operate across one or more frequencies capable of supporting data communication such as cellular frequencies, the 4.9 GHz public safety frequency, licensed and unlicensed wireless (e.g. 70 GHz and 90 GHz), 2.4 GHz, and 5.8 GHz, and other microwave and satellite communication frequencies among others. Wireless connections may also comprise optical wireless connections, such as a laser or other light based communication. It is noted that, as described regarding the network 104, any communication link now know or later developed whether packet switched, circuit switched, connection based, connectionless, or otherwise may be used to facilitate communication via the communication link 108.

[0068] FIG. 2A is a block diagram illustrating an embodiment of the peer to peer surveillance architecture where each node is connected through network one, similar to the above. FIG. 2B is a block diagram illustrating an embodiment of the surveillance architecture where each node 100 is connected through more than one independent network 104. In addition, the networks 104 themselves may be connected by a communication link 108 as well. Thus, communications to and from each node 100 may be routed through a single network or both networks. The communication links 108 from each node 100 to each network 104 provide redundancy allowing the surveillance architecture to fully function even if one or more of the communication links 108 are not operational. In addition, as stated above, each communication link 108 may comprise one or more independent connections, as desired, further increasing the architecture’s reliability.

[0069] Of course, a network 104 or networks may be configured in a multitude of ways as is well known in the art. In one or more embodiments, the network 104 may be a single switch or router such as in a local area network, or may include one or more switches, routers, and other devices, such as a wide area network or the Internet. It is noted that nodes 100 may also communicate directly through one another rather than through one or more other devices. For example, two nodes 100 may have a direct wireless connection between one another such as an ad hoc 802.11/b/g connection or a direct cable connection. It is contemplated that the nodes 100 may communicate with a network through another node in one or more embodiments.

[0070] In one or more embodiments, each node 100 may be connected to every other node through a logical connection, such as for example, nodes connected to one another in an IP or other packet switched network. Generally, a logical connection may be thought of as the end to end connection which allows data from a source to reach its proper destination as it travels across one or more physical or wireless connections. The term virtual matrix switch as used herein refers to the logical connections that allow communication between the nodes 100 of a surveillance system.

[0071] The virtual matrix switch allows surveillance information to be communicated between individual nodes 100, but also supports multicasting surveillance information to a plurality or all of the nodes regardless of the underlying physical or wireless connection type. When connected through a virtual matrix switch, each node 100 will be in a virtual or logical network with only its peer nodes in one or more embodiments. To illustrate, in one embodiment, each node 100 is connected to peer nodes by one or more networks and communication links. Though these networks and communication links may be public or private networks and communication links shared by other devices, the virtual matrix switch provides a virtual or logical network which only the nodes 100 are part of. Communications within the virtual matrix switch may be encrypted, such as through GRE tunneling or VPN connections, in some embodiments.

[0072] FIG. 3 illustrates an embodiment of a node 100. In one or more embodiments, a node 100 may comprise any combination of one or more processors 304, memory 308, and storage 312 that is capable of processing, and executing machine readable code from the memory 308, storage 312, or both in one or more embodiments. Generally, the processor 304 may be any device capable of executing machine readable code and transmitting and receiving data. The memory 308 and server storage 312 may be any data storage device or devices capable of storing data. The memory 308 and storage 312 will typically allow both reading and writing data, however, in some embodiments at least a portion or all of either the memory 308 or storage 312 may be read only. It is noted that in some embodiments, memory 308 or storage 312 alone will be sufficient to store any data or machine readable code required by the node 100 and that because of this, not all embodiments will require both memory 308 and storage 312.

[0073] In some embodiments, the machine readable code controls the operation of the nodes 100. The machine readable code may be one or more programs such as an operating system running one or more applications. The machine readable code may also provide compression and decompression of surveillance information as will be described below. In one embodiment, the machine readable code is configured to allow a node 100 to communicate by unicast, multicast, or broadcast over a virtual matrix switch.
In one or more embodiments, a node 100 comprises one or more transceivers 320 configured for two-way communication in that each transceiver may receive and transmit information or data to one or more other nodes 100 through one or more communication links 108, one or more networks 104, or a combination thereof. A transceiver may be configured to communicate by unicasting, multicasting, or broadcasting information through one or more wired or wireless connections. In some embodiments, one or more of the transceivers 320 may only transmit or only receive data. It is contemplated that a transceiver 320 may also communicate with other external devices as well as nodes 100.

In one or more embodiments, the one or more transceivers 320 may be connected to one or more communication links 108. As stated above, the communication links 108 may be physical or wireless links and may utilize one or more communication protocols. As stated, wireless links in one or more embodiments may also comprise a cellular link using various communication protocols. For example, a transceiver 320 may be configured to communicate through a TDMA, CDMA, FDMA, or other cellular network. A cellular communication link 108 allows for long range wireless communication and provides the advantage of network availability even in remote areas. Though cellular communication links 108 may have limited bandwidth, the peer to peer surveillance architecture provides data compression to overcome this limitation as will be discussed further below. It is contemplated that a wireless communication link 108 may comprise wireless communication with one or more satellites and that wireless communication may be accomplished through one or more antenna 324 if desired. The antenna 324 may be internal to the node 100 or may be an external antenna connected to the node 100.

As stated, each node 100 may have one or more communication links 108 for redundancy. This may be accomplished by configuring a node 100 with more than one transceiver 320, or by configuring a node with a single transceiver capable of having more than one communication link. Only one communication link 108 is necessary for communication, thus any additional communication links 108 may be used to increase available bandwidth such as by simultaneously utilizing all available communication links 108 to transmit data, receive data, or both. However, a node 100 may also be configured to utilize the additional communication links 108 only when the currently used link or links is damaged or fails. Also, a node 100 may be configured to choose which communication link 108 to use based on a predetermined order or based on the available bandwidth, latency, or other characteristic of the links.

It is contemplated that any combination of communication links 108 may be used by a single node 100. For example, a node 100 may have an IP communication link 108 through wired Ethernet, a cellular communication link, and a wireless 802.11 link simultaneously. One or more of these communication links 108 may be used simultaneously or may remain unused (i.e. inactive) unless one or more of the other links is damaged or fails.

In one embodiment, the nodes 100 communicate through a communication link 108 using IP based communication. IP networks are inherently reliable and may be configured to automatically route data through alternate links based on network congestion or availability. IP based communication also allows multicausing which may be used to reduce bandwidth utilization. In addition, a node 100 communicating via IP may communicate to or through any IP based device or network including the worldwide Internet. This allows nodes 100 to communicate around the world with very little expense. Thus, IP networks are well suited for a surveillance application, however, it is noted that the peer to peer surveillance architecture may be used with any type of network or communication protocol.

In one or more embodiments, a node 100 also comprises a power source 316. The power source 316 provides power to the node 100 so that it may be used without being connected to an electric power grid. The power source 316 may be any device capable of providing sufficient power for a node 100. Such devices include but are not limited to batteries, solar panels, wind turbines, and generators or a combination thereof. In one embodiment, a node 100 has a power source 316 comprising one or more batteries and a solar panel which recharges the batteries. In another embodiment, a generator is provided which may power to node 100 directly or be used to recharge any batteries the node may have. The generator or other power supply may be refueled periodically or as necessary to provide power. It can thus be seen that a node 100 with a power source 316 and a wireless communication link 108 may be quickly and easily deployed virtually anywhere.

Components of the nodes 100 such as the processor 304, memory 308, storage 312, or transceivers 320 may communicate with one another in one or more embodiments. In addition, the power source 316 component may be configured to communicate power utilization, power reserves, battery condition, or other information in one or more embodiments. Components of the nodes 100 also include capture devices, screens, and control interfaces as will be described further below. It is contemplated that other devices may be components of a node 100 such as but not limited to one or more lights or speakers.

In one or more embodiments, communication between components takes place through one or more optical, electrical, or wireless data connections. These connections may allow unidirectional or bi-directional communication between the components. It is contemplated that in some embodiments, not every component will be connected to every other component.

In one embodiment, only the processor 304 is connected to the memory 308, storage 312, and one or more transceivers 320. In another embodiment, some components may be connected to more than one other component. For example, the one or more transceivers 320 may be connected to the memory 308, storage 312, or both, in addition to being connected to the processor 304. In this manner, the one or more transceivers 320 may utilize the memory 308, storage 312, or both without communicating with the processor 304. It is contemplated that in some embodiments, one or more components may communicate within the node through a connection with another component.

In some embodiments, the components described above may be “off the shelf” products from various manufacturers. For example, a node may be a computer having a processor 304, memory 308, storage 312, and one or more transceivers 320 installed on a motherboard. In other embodiments, the components may be provided by one or more independent “off the shelf” products. For example, the processor 304, memory 308, and storage 312 may be a computer or video processing device connected to an external camera, and one or more external transceivers 320. The processor 304
may for example be a stand alone device which accepts video as an input and compresses, analyzes or otherwise processes the video and outputs the result. The storage 312 may comprise one or more stand alone storage devices such as, for example, a set of hard drives, a RAID array, or USB or Firewire storage. It is contemplated that there may be more than one of each component for redundancy. Where more than one of the same component is included in a node 100, it is contemplated that each may be used simultaneously or that one or more redundant components may remain inactive until needed.

It is contemplated that a node 100 may be located in mild environments and harsh or extreme environments (e.g. extreme heat, cold, moisture, or wind). Thus, each node 100 may be configured with various enclosures or structures capable of supporting its components. For example, a node 100 used indoors may have an enclosure as simple as an equipment rack or shelf. Alternatively, an indoor enclosure may fully enclose the components of a node 100 such as with a metal, plastic, or other rigid cover. A node 100 for outdoor use may have a more rugged enclosure such as by using stronger or thicker materials. In addition, some enclosures may have wind, water, ice, heat or other weather resistance. This may be accomplished by insulating the enclosure and by including one or more seals to prevent weather infiltration. Enclosures may include structures that do not fully enclose a node’s components, and may include structures now known and later developed, such as described below.

Generally, an enclosure will be a single continuous rigid structure which supports all the components of a node 100. A component of a node 100 will be considered to be supported by the enclosure as long as the component is ultimately supported by the enclosure. A component may be supported by the enclosure through one or more other structures. For example, a component held within or attached to its own case or support is considered supported by the enclosure as long as its case or support is attached to the enclosure.

Of course, in some embodiments, some components may not be supported or attached to an enclosure. For example, a camera may be attached directly to a wall rather than to an enclosure. In addition, some enclosures may have portions that may be removable attached to allow for repair or replacement. It is noted that, such enclosures are still considered to be a single continuous structure because each removably attached portion will be attached when the node is in operation. Various embodiments of enclosures will be described further below.

Types of nodes will now be described. These nodes may include the basic components of and may be configured according to the various embodiments of the nodes 100 described above. In addition, the following nodes generally include additional components suited for one or more specific tasks in their various embodiments.

FIG. 4 illustrates an embodiment of a capture node 400 of the peer to peer surveillance system. Generally, a capture node 400 is a node configured to capture surveillance information from one or more target areas. A target area is generally an area where useful surveillance information may be gathered, but may be any area or location. Surveillance information may include video, audio, or both, as well as information from specific sensors such as voltage, current, temperature, radiation, motion, or light sensors. Surveillance information may also include information or data derived from the above information, or data received from an external source such as wireless stock ticker, traffic, GPS, or weather data.

In one or more embodiments, a capture node 400 may comprise a processor 304, memory 308, storage 312, power source 316, one or more transceivers 320, one or more antenna 324, or various combinations thereof as described above. Regardless of the configuration, a capture node 400 will generally include one or more capture devices 404 as one of its components in one or more embodiments. Once captured, surveillance information may be transmitted from the capture node 400 via its one or more transceivers 320.

A capture device 404 is a device configured to receive, record, or otherwise capture surveillance information. The capture device 404 may be integrated with one or more components of the capture node 400 in one or more embodiments. For example, the capture device 404 may be a video capture board. The capture device 404 may also be a stand alone device in some embodiments. For example, the capture device 404 may be a camera connected to the processor 304 of the capture node 400. It is contemplated that the capture device 404 may be movable (e.g., a pan, tilt, and zoom camera) to focus on specific events or areas periodically, in response to an event, or as desired.

As stated, there is a wide variety of surveillance information, and thus, a similarly wide variety of capture devices 404 are contemplated. To illustrate, the capture device 404 may also comprise one or more cameras, microphones, temperature sensors, radiation detectors, motion detectors. In addition, the capture device 404 may be a data input such as for receiving telemetry from other devices. For example, the capture device 404 may be a radio receiver configured to receive traffic, weather, GPS, or even stock ticker information. The capture device 404 may be a voltage or current sensor such as for detecting voltage or current usage or for detecting a completed circuit such as in contact sensors for security systems.

In one embodiment, the capture node 400 is configured to capture video surveillance information. As such, the capture node 400 has a capture device 404 comprising a video camera. The camera may be fixed or may have point, tilt, and zoom capability and may provide a video stream of a target area. Pan, tilt, and zoom cameras may be moved to focus on different areas as desired or according to a predetermined surveillance plan. In addition, such a capture node 400 may be programmed to automatically focus its camera (or other capture device) on an area in response to an event or notification or be remotely controlled such as through an external device or node in communication with the capture node 400.

In one or more embodiments, a capture node 400 may compress the surveillance information it is transmitting such as to save storage space, to save bandwidth for multiple streams of information, or to allow transmission of data across low bandwidth communication links. In one embodiment, a capture device 404 sends surveillance information to a processor 304 in the capture node 400. It is noted that the processor 304 may process the surveillance information in a number of ways. For example, the processor 304 may analyze the information, as will be discussed further below, or may compress the information.

In one or more embodiments, compression may occur through a compression algorithm or software comprising machine readable code stored on the memory 308, storage 312, or both. Any compression algorithm, now known or later
developed, that can be executed by the processor 304 may be used. Some examples of compression algorithms for various types of data include: H.261, H.264, G.711, ZIP, LZW, JPG, MPEG-1, MPEG-2, and MPEG-4. It is noted that the compression algorithm used will depend on the type of information to be compressed and the desired data rate, quality, or both of surveillance information after compression.

[0096] With regard to video surveillance, compression/decompression algorithms or software known as a video codec, may be used to accept analog video and then digitize, compress, and packetize it so it may be sent to its destination. Video compression and decompression requires significant hardware and software capabilities. In a worst case situation, where a video scene has simultaneous background and foreground scene complexity (e.g. shapes and patterns that are dissimilar in color, texture, shape, hue, etc. . . . ) and simultaneous 3-axis camera movement (e.g. pan, tilt and zoom all at the same time), along with 3-axis target movement (e.g. a suspect or vehicle moving at or away from the camera at a diagonal), the codec may be required to process as much as 6,400,000,000 instruction sets per second or more. Traditional security industry codecs will drop frames or produce DCT (Discrete Cosine Transfer) blockiness, or both, when subjected to such harsh conditions because traditional codec simply cannot process the instructions quickly enough.

[0097] Furthermore, conversion from analog to digital is done in “real time” where massive amounts of analog data are converted to digital in real time. If the information cannot be processed quickly enough, some of the data is thrown away (e.g. dropped frames) during the compression process. The difference between the theoretical real time transformation and the actual transformation (the time delta) is called latency. A respectable latency (from the capture of video to its subsequent viewing) for 4 CIF images at 30 frames per second is under 180 milliseconds. If compression drops frames or introduces blockiness, the surveillance information is largely worthless.

[0098] Thus, in one or more embodiments, a capture node 400 may include an ASIC (Application Specific Integrated Circuit) to meet the video compression requirements defined above. For example one or some of the processors 304 of a capture node 400 may be ASIC’s designed to compress video according to one or more types of compression as discussed above. For example, the ASIC may compress (and/or decompress) video according to one or more video codecs. It is contemplated that video and other surveillance information may be compressed and decompressed through one or more ASICs and that other nodes, besides capture nodes 400, may utilize ASIC’s in one or more embodiments. It is contemplated that compression and/or decompression of surveillance information may be performed, as described herein, on any node of the peer to peer surveillance architecture.

[0099] Each capture node 400 may transmit multiple streams of video or other surveillance information, and each stream’s network utilization may be managed differently. For example, a capture node 400 may set a first stream to 1 Mbps and UDP multicast, a second stream may be set for 256 kbps and unicast, and so on. The network utilization of each stream of surveillance information may be set based on network capabilities (e.g. available bandwidth) or other conditions such as the monetary cost of transmitting surveillance information over particular communication links. It is noted that other nodes 100 of the peer to peer surveillance architecture may transmit multiple streams of surveillance information as well.

[0100] In some embodiments, the capture node 400 may be configured to store captured surveillance information in addition to or instead of transmitting it. The surveillance information may be compressed prior to its storage and may be written to the capture node’s 400 storage 312, such as magnetic, optical, or flash media, if desired. Various forms of storage 312 may be utilized as will be described further with regard to the content storage nodes of the peer to peer surveillance architecture. A capture node 400 may transmit live surveillance information, stored surveillance information, or both alone or simultaneously, if desired.

[0101] It is contemplated that capture nodes 400 may be configured to analyze surveillance information and provide one or more notifications if a particular event is detected. For example, a capture node 400 may be configured to execute analysis software. This software may execute on one or more processors 304 of the capture node 400. Analysis of surveillance information and notifications are described further below with regard to the server nodes of the peer to peer surveillance architecture.

[0102] In one embodiment, the capture node 400 may be a cellular node. In this embodiment, at least one transceiver 320 is configured to communicate through a cellular communication link or network. Cellular connections may have reduced or limited bandwidth and thus compression may be used to compress surveillance information before it is transmitted. Of course, where there is sufficient bandwidth, uncompressed surveillance information may be transmitted.

[0103] Video surveillance information from will generally be compressed prior to transmission over a cellular connection due to its higher bandwidth requirements. As stated above, video compression may require significant processing power to provide video with a high frame rate, no artifacts, and no dropped frames. This is especially so on reduced bandwidth connections such as cellular connections. Thus, though not required in all embodiments, it is contemplated that a cellular capture node 400 or other node having a cellular transceiver may include an ASIC configured to compress video suitable for transmission over a cellular connection.

[0104] It is noted that a cellular transceiver 320 may communicate to other nodes 100 through the virtual matrix switch described above if desired. Thus, captured surveillance information may be unicast, multicast, or broadcast to other nodes 100 through a cellular connection. This is advantageous in a cellular connection (or other reduced bandwidth connections) because multicast or broadcast transmissions allow multiple or all the nodes 100 to receive the same surveillance information from a single transmission stream.

[0105] A cellular capture node 400, or other node having a cellular transceiver, also has the advantage of being capable of having network connectivity in remote locations because its cellular transceiver 320 may communicate over long distances wirelessly. Thus, it is contemplated that some embodiments of a cellular node may include one or more power sources 316 to allow the cellular capture node to operate without any wired connections. The cellular node may then be quickly and easily deployed nearly anywhere by simply placing it where it can capture surveillance information from one or more desired target areas.

[0106] FIG. 5 illustrates an embodiment of a viewing node 500. Generally, a viewing node 500 is used to view live and
stored surveillance information as well as control playback of live or stored surveillance information. A viewing node 500 may also be used to select the surveillance information to be viewed as well as various representations or arrangements of the surveillance information. For example, the desired live or stored video surveillance from one or more nodes may be selected and viewed on the viewing node 500. In addition, the viewing node 500 may display other surveillance information in a table, graph, pie chart, text, or other arrangement.

[0107] It is contemplated that a viewing node 500 may also display or emit various alarms or warnings. For example, audible warnings, email alerts, and notifications of network or capture node failures may be presented visually or audibly via a viewing node 500. These alarms or warnings may result from one or more notifications transmitted by other nodes 100, as described below, and received by the viewing node 500.

[0108] In one or more embodiments, a viewing node 500 may comprise a processor 304, memory 308, storage 312, power source 316, one or more transceivers 320, one or more antenna 324, or various combinations thereof as described above. In addition, the viewing node 500 is a node and thus may comprise any configuration described above with regard to FIG. 3. A viewing node 500 may include one or more screens 504, control interfaces 508, or both as components in one or more embodiments. It is contemplated that a viewing node may be a personal computer (PC), smart phone (e.g., BlackBerry, iPhone), or personal media player in one or more embodiments. As these devices are nearly ubiquitous, a further advantage of the invention is that surveillance information from any node may be viewed virtually anywhere.

[0109] The screen 504 may be a high resolution color display such as a computer monitor or LCD screen. Any type of screen 504 may be used with the viewing node 500. This includes but is not limited to television monitors, black and white monitors, plasma and LCD screens, and projectors.

[0110] In some embodiments, surveillance information from other nodes 100 is displayed on a screen 504 in a viewing pane 512 comprising a portion of the screen. As stated, the nodes 100 may be various combinations of capture, server, storage, and other nodes described herein. It is contemplated that there may be one or more viewing panes 512 displayed on a screen 504, and that each viewing pane 512 may display surveillance information from one or more nodes 100. A user may be provided a list of nodes 100 and be allowed to select which node or nodes he or she wishes to view.

[0111] In one embodiment, the viewing panes 512 are displayed in various layouts such as 2x2, 3x3, 4x4, and 5x5. In other embodiments, the viewing panes 512 may be displayed according to a custom layout, such as shown in FIG. 5. For example, important viewing panes 512 may be displayed larger than other viewing panes. The viewing panes 512 may be assigned to one or more groups and entire groups of viewing panes may be selected for viewing simply by selecting the desired group. This may be used to view surveillance information from an entire site or salvo of nodes 100.

[0112] In one or more embodiments, surveillance information will be received by the viewing node 500 through one or more transceivers 320 connected to one or more communication links 108. It is noted that each viewing node 500 may also transmit data such as to initiate communications with other nodes 100, request surveillance information, and control capture node cameras or other capture devices. The viewing node 500 may also output or export surveillance information so that it may be recorded by an external device. For example, video surveillance information may be exported to a video file, or may be output to a VCR, DVD, or other recording device or media for recording. It is contemplated that surveillance information may be exported to industry standard formats and be watermarked or signed to ensure its authenticity. Other nodes may also export surveillance information.

[0113] As stated, surveillance information may be uncompressed or compressed. Where the surveillance information is compressed, the viewing node 500 may decompress the surveillance information before it is viewed. This may occur by the processor 304 executing one or more decompression algorithms on the incoming surveillance information.

[0114] Of course, the proper decompression algorithm must be determined and such determination may occur by a handshake communication where one node notifies another of the algorithm it is using to compress information. The proper algorithm may also be determined by a node analyzing the incoming surveillance information. In some embodiments, a node may present the compression types it is capable of decompressing and the source node may select a compression algorithm accordingly. In essence, nodes may agree on which compression algorithm to use. It is contemplated that the communication of any type of surveillance information between any nodes of the peer to peer surveillance architecture may be facilitated by the handshake communication.

[0115] In addition to viewing panes 512, a viewing node 500 may display surveillance information on a timeline. In this manner, surveillance information is generally displayed according to the time it was captured or recorded. The timeline may have a resolution from one second to one month, but this range of resolution may be increased or decreased in one or more embodiments. The timeline provides the advantage of allowing surveillance information to be viewed together with the time it was captured or corresponding to other times. In this manner, more than one stream or type of surveillance information may be viewed such that any surveillance information for a particular time may be viewed together. For example, a video may be viewed synchronized with telemetry information, audio, or even other video. The timeline may be scrolled across the screen 504, or set to a specific start time, end time, or both.

[0116] In one or more embodiments, a viewing node 500 may include one or more control interface 508. A control interface 508 has the advantage of specific buttons, switches, or other controls not commonly found on a keyboard or mouse. In one embodiment, a control interface 508 may have media player type controls such as play, pause, fast forward, rewind, single frame advance or reverse, slow motion forward or reverse play, and stop. In addition a jog shuttle may be provided in some embodiments. The jog shuttle may be a circular knob which, when turned, allows fine control of the speed of the forward or reverse playback of surveillance information.

[0117] The playback or display of surveillance information on each viewing pane 512 may be individually controlled by the control interface 508. In addition, the controls may be used to control other aspects of viewing such as the volume of audio, or the magnification (i.e. zoom) of video. In one or more embodiments, signals comprising instructions to control the display of surveillance information, are generated
from the operation of the control interface 508 and received by control interface’s attached node.

[0118] In one embodiment, one or more of the viewing panes 512 is used to view video surveillance information. In this embodiment, available video surveillance information may be selected for viewing. The video surveillance information may be listed for selection with a text or other label, a thumbnail, or both. Each list item corresponds to the surveillance information provided by a particular node 100 or nodes. For example, a list item labeled “Building 10 Northeast Corner” may correspond to a capture or other node on the northeast corner of Building 10. Based on this, a user may then choose one or more videos for viewing as he or she desires. It is noted that other types of surveillance information may be similarly listed for selection with a text or other label, thumbnail, summary, or combination thereof.

[0119] In one or more embodiments, a viewing node 500 may be configured to store the last 30 seconds of surveillance information received by the viewing node on its storage 312, memory 308, or both. For example, the last 30 seconds of live video surveillance may be stored so that a user may easily review the last 30 seconds of events. In some embodiments, this storage of video or other surveillance information is temporary and may be more or less than 30 seconds if desired.

[0120] FIG. 6 illustrates an embodiment of a content storage node 600. Generally, a content storage node 600 is configured to store surveillance information captured or transmitted from other nodes 100, and to transmit stored surveillance information to other nodes. These other nodes 100 may be any type of node including but not limited to a capture node, viewing node, or even other storage nodes.

[0121] In one or more embodiments, a content storage node 600 may comprise a processor 304, memory 308, storage 312, power source 316, one or more transceivers 320, one or more antenna 324, or various combinations thereof as described above. Generally, content storage nodes 600 will include storage 312 to store the surveillance information received from other nodes 100.

[0122] The storage 312 in one or more embodiments is one or more hard drives. The hard drives may be configured in a RAID configuration, such as RAID 1 or RAID 5, in one or more embodiments. Of course various forms of storage 312 may be used. For example, the storage 312 may be internal or removable optical, magnetic, or flash media. In some embodiments, the storage 312 may be written to only once such as with DVD-R or CD-R technology. In other embodiments, the storage 312 may allow repeated reading and writing such as with a hard drive or other magnetic media.

[0123] A content storage node 600 is capable of storing both compressed and uncompressed surveillance information. For example, the content storage node 600 may receive compressed video from another node 100. Where compressed surveillance information is received it may be directly stored or, if desired, the content storage node 600 may decompress the information before it is stored. In addition, uncompressed surveillance information received by the content storage node 600 may be directly stored or compressed before it is stored. Compression will generally occur through one or more compression or decompression algorithms executed on the processor 304 as described herein. In addition, content storage nodes 600 may also go through a handshaking process with other nodes as described above. In this manner, the content storage nodes 600 may agree upon a compression/decompression algorithm for a particular transmission of surveillance information.

[0124] A content storage node 600 may be configured to transmit stored surveillance information in one or more embodiments. Surveillance information may be transmitted in compressed or uncompressed form regardless of how it has been stored. In addition, it is contemplated that surveillance information stored according to one type of compression may be recompressed with another type of compression prior to its transmission. This is advantageous in that it allows surveillance information to be compressed with another type of compression that may have reduced bandwidth requirements. In addition, some nodes may not support all compression types. Thus, the content storage node 600 may recompress surveillance information according to a compression type supported by the nodes it is communicating with. Of course, compressed surveillance information may be decompressed and transmitted as uncompressed surveillance information.

[0125] One advantage of a content storage node 600 is that surveillance information may be stored in multiple physical locations. For example, a capture node may transmit surveillance information to a plurality of content storage nodes 600 in various locations. In this manner, the surveillance information is preserved even if one or more of the content storage nodes 600 is damaged or destroyed. Similarly, surveillance information may be retrieved from multiple physical locations. For example, if connectivity to a geographic region, building, office, or other physical location is reduced or unavailable, the desired surveillance information may be retrieved from a content storage node 600 in a different physical location.

[0126] FIG. 7 illustrates an embodiment of a server node 700. Generally, a server node 700 is configured to provide services related to authenticating access to and analyzing surveillance information. The server node 700 may be configured to authenticate requests for or access to surveillance information, analyze live or stored surveillance information, or both.

[0127] In one or more embodiments, a server node 700 may comprise a processor 304, memory 308, storage 312, power source 316, one or more transceivers 320, one or more antenna 324, or various combinations thereof as described above. In addition, the server node 700 is a node and thus may comprise any configuration described above with regard to FIG. 3.

[0128] In one embodiment, the server node 700 provides authentication capability. The server node 700 may use commercial software to accomplish this, such as Active Directory authentication in Microsoft Windows. Of course, the server node 700 does not have to utilize Active Directory as it is contemplated that any system, new known or later developed, where one or more user or other access accounts may be managed and authenticated through one or more server nodes 700 may be used with the peer to peer surveillance architecture.

[0129] In a peer to peer configuration, the server node 700 may validate a user's or a device's credentials and allow or deny access to the peer to peer surveillance architecture accordingly. In one or more embodiments, this may occur by the server node 700 returning a key or code which allows access to other nodes 100 of the surveillance architecture. Each node may be configured to respond only to one or more particular keys. It is contemplated that, in one or more
embodiments, the keys may be generated through use of
digital signatures, encryption, hashing algorithms, or both,
now known or later developed, such as in a public key infra-
structure.

[0130] The server node 700 may also be used to manage
user or other access accounts such as by assigning access
privileges or restrictions to a user or other account or to a
group of accounts. The privileges or restrictions may be set on
the server node 700 to vary depending on the particular node 100
or group of nodes being accessed.

[0131] In embodiments of the peer to peer surveillance
architecture where authentication is required for access, it is
contemplated that a plurality of server nodes 700 providing
authentication services may be used for redundancy. These
can be deployed in different physical locations to increase
reliability as described above. It is contemplated that changes
to user or other accounts may occur through any server node 700
which then may update other server nodes within the surveillance
architecture accordingly.

[0132] In one embodiment each node 100 may be con-
figured with one or more access codes or usernames and pass-
words which allow access to a node if correctly presented to
the node. This embodiment does not require a server node 700
as each node 100 may authenticate access requests itself. One
or more server nodes 700 may be utilized to manage user or
other access accounts for each node 100 in this embodiment
however.

[0133] One advantage of authentication is that each user or
device may have their own accounts. This allows different
access levels depending on the user or device and prevents the
entire peer to peer surveillance architecture from being com-
promised if one or more access codes are revealed. Access
codes may be changed as desired to further enhance the
security of the surveillance architecture. Though this may be
implemented at each node 100, use of one or more server
nodes 700 providing authentication services has several
advantages. One advantage is that accounts and access codes
may be created, modified, or deleted at any server node 700.
Each server node 700 may synchronize account and access
code information to provide full redundancy for the authen-
tication services.

[0134] Another advantage is that the server nodes 700 may
be configured to log and audit access requests or other authen-
tication activities. All user and system activity may be col-
lected in the audit log along with the time at which the activity
occurred. For example, a user’s viewing of live or recorded
surveillance information may be logged in the audit log. In
this manner, a security audit may be performed on the peer
to peer surveillance architecture to ensure its integrity. The audit
log may be mirrored or copied to other server nodes 700,
content storage nodes, or other nodes having storage for
redundancy.

[0135] Server node based authentication is particularly use-
ful in large surveillance architectures, such as city-wide sur-
veillance architectures with hundreds to thousands of users
and nodes. Managing access to individual nodes 100 may
occur at each node, such as by setting up user or device
accounts on each node. However, it is much easier to manage
access to the nodes 100, especially in large surveillance archi-
tectures, from the one or more server nodes 700.

[0136] In one or more embodiments, a server node 700 may
be configured to provide analysis of surveillance information
it receives. This analysis may generally be performed through
analysis software or machine readable code executing on one
or more processors 304. With regard to video surveillance
information, a server node 700 may accept an incoming video
stream to detect one or more events such as by analyzing the
video to detect or recognize motion, images or particular
events. In addition, the server node 700 may have software
capable of creating virtual tripwires, detecting objects that
have been left behind by one or more subjects. Any analysis
software may be used, and thus a variety of analysis may be
performed including license plate and facial recognition.
Software requiring specific video formats may be utilized as
well because the server node 700 may request video of a
specific format, such as a specific video format or compression
type, from the other nodes 100. In addition, it is contemplated
that the server node 700 may convert incoming video to a
format usable by the analysis software if necessary.

[0137] The server nodes 700 may also provide analysis of
other surveillance information to detect particular events
therein. For example, weather information may be collected
by various capture nodes and analyzed to track temperatures,
wind speed, humidity, or other data for a geographic area.
Each server node 700 may be configured to perform one or
more analysis services of other server nodes 700. In this way,
redundancy is provided for any analysis service used by
the peer to peer surveillance architecture. In addition, one or
more server nodes 700 may work together to analyze a
particular stream or set of surveillance information. The results
of the analysis of surveillance information may be stored on
the server node 700, content storage nodes, or even other
nodes.

[0138] In one or more embodiments, users may setup trig-
gers which are activated when particular events are detected.
For example, one or more server nodes 700 may be config-
ured to notify one or more users when a particular event is
detected. Notification may occur by email, phone, text mes-
sage, on screen dialogs, sounds, or other methods. It is
noted that each server node 700 may provide different analy-
sis services and have different triggers and notification set-
ings. One or more content storage nodes may be configured
with analysis, triggering, and notification capabilities as well,
in one or more embodiments.

[0139] In addition to notifying users, other nodes may be
notified when particular events occur. For example, capture
nodes with cameras may be notified to zoom in or focus on an
area when a virtual tripwire is tripped or when a particular
event is detected. Notification of another node may occur by
one node communicating a notification message including
information regarding an event to another node. The detection
of an event includes recognizing animate or inanimate objects
and may trigger further analysis by the same or one or more
other server nodes 700. It is noted that any node may provide
notification, such as for example, a node providing a notifica-
tion of a communication link failure, or hardware or soft-
ware failure.

[0140] It is contemplated that the peer to peer surveillance
architecture may include one or more hybrid nodes in some
embodiments. A hybrid node may combine components of
the types of nodes described above. For example, in one
embodiment, a capture node may include storage as described
with regard to a content storage node, or vice versa. In other
embodiments, the capture node may include a screen for
viewing captured surveillance information, or may provide
authentication services, analysis services, or both. In yet
another embodiment, a viewing node may be configured to
provide analysis services. The above listing of exemplary
hybrid nodes is not intended to be exhaustive or limiting, as a wide variety of hybrid nodes may be formed from the components of the nodes disclosed herein.

[0141] As stated, peer to peer means that each node within the surveillance architecture operates independent from (i.e. does not rely on) its peer nodes. In traditional surveillance systems, a central control device or controller aggregates incoming surveillance information and, if so configured, also sends control instructions to its connected capture devices. This creates a single point of failure because each capture device relies on a single central controller in order to function. This also limits the number of capture devices and simultaneous users to the capacity of the control device. In contrast, the peer to peer surveillance architecture does not rely on any central control device as each node is independent.

[0142] To illustrate, failure to receive video surveillance from a surveillance camera can be due to various causes. For example, the cable from the camera may be damaged, the device receiving video surveillance may malfunction, or the camera itself may be malfunctioning. In a traditional system with central control, any one of these problems prevents the capture and use of surveillance information because the central controller is not receiving any surveillance information.

[0143] With the peer to peer surveillance architecture herein: where there is a damaged cable, a capture node may utilize one or more redundant communication links, where a viewing node is malfunctioning, a user may simply use another viewing node; and where the capture node is malfunctioning a redundant capture node at the same location may be used. As stated, a viewing node may be a PC, smart phone, or personal media player in one or more embodiments, and thus, switching to another viewing node is easily accomplished within the peer to peer surveillance architecture.

[0144] Furthermore, capture nodes may store the surveillance information they capture or transmit to other nodes for analysis, storage or both. Thus, in the unlikely event that a user cannot view surveillance information through a viewing node, the captured surveillance information is not lost. Though the user is temporarily unable to view the surveillance information, he or she may still be notified by one or more server nodes analyzing the information for particular occurrences, and the information may be stored for later review by the user.

[0145] It is noted again that, users and viewing nodes (and any other node) may be in different geographic locations and use more than one completely independent network to communicate. Thus, the failure of a cable or even an entire network in one or more locations does not prevent the peer to peer surveillance architecture from operating. For example, a single node may have a cable Internet connection, a cellular connection, and an ISDN connection.

[0146] The nodes themselves may have redundant components. For example, a capture node may have more than one camera or other capture device, or a content storage node may be configured with a RAID storage array. It is contemplated that a node may be configured such that each component has a backup or redundant counterpart. Such redundancy is not available in traditional systems.

[0147] A highly available surveillance system includes devices that have a high Mean Time Between Failure (MTBF), and Mean Time Between Critical Failure (MTBCF). As discussed above, the peer to peer relationship between nodes ensures no loss of service during a node, communication, or network failure. However, after a failure and until the failed node, communication link, or network is fully operational the peer to peer surveillance architecture may be operating under less than optimal conditions. For example, redundant communication links may have less bandwidth and more latency, or be more expensive. Also, where there already has been a failure, an additional failure may result in loss of surveillance capability. Thus, the peer to peer surveillance architecture provides another advantage in that it has a low Mean Time To Repair (MTTR) in one or more embodiments.

[0148] As an initial matter, the nodes themselves may be configured with components having a high MTBF and MTBCF to reduce failures and the need for repairs. Various node configurations, protective components, and enclosures may be used to protect node components from environmental threats which may lower a component’s MTBF or MTBCF, such as high or low temperatures, power surges, lightning, and humidity.

[0149] In addition, nodes may be configured to allow access by qualified technical or other personnel. This access to a node is highly advantageous in maintaining and repairing individual nodes. In one or more embodiments, operating information including information regarding hardware and software abnormalities or failures may be stored by the nodes. This information can be used to prevent node failures, such as by allowing preventative maintenance to occur, as well as to optimize node performance. It is contemplated that the nodes may have internal diagnostics and may allow technicians or other personnel to access operating information, change hardware or software settings, or run diagnostics through a diagnostic connection with the node. The diagnostic connection may be authenticated and occur through one or more communication links, networks, or a combination thereof as discussed above.

[0150] The diagnostic connection allows quick diagnosis over a remote or direct connection to reduce a node’s MTTR. Repairs, such as changing hardware or software settings may be implemented through the diagnostic connection as well. Where replacement hardware is necessary, the diagnostic connection may be used to quickly identify what hardware to be replaced.

[0151] It is noted that, because the nodes are independent, a repair may occur simply by replacing a damaged node with a new one. While the new node is in place, the damaged node may be diagnosed and repaired. It is contemplated that configuration settings for a node may be saved external to the node or exported from the node and imported into a similarly configured node to allow for rapid replacement of individual nodes.

[0152] In one or more embodiments, diagnosis of software or hardware issues may occur through one or more diagnostic routines or programs. Generally, these routines or programs input data into one or more of a node’s components and confirm that the corresponding output from the components is as expected or within an acceptable range for a properly functioning component.

[0153] The peer to peer surveillance architecture has another advantage in that maintenance updates or upgrades may be performed without impacting the overall surveillance architecture. This is because each node may be individually updated or upgraded without interrupting the operation of any other node. It is noted that, in contrast to an unplanned failure, updates and upgrades may be planned in advance so as to occur when operation of a particular node is not crucial.
Updates include firmware or other software updates for a node's components, and may include replacement of components with new revisions of the same. Upgrades generally may be thought of as software or hardware replacements that increase the node's or a particular component's capabilities or capacity, reduce power consumption, or provide other benefits.

[0154] As stated various enclosures may be used to support and/or protect the components of various nodes of the peer to peer surveillance architecture. In one embodiment, enclosures may be configured to protect node components from natural, man-made and other hazards that could damage a node. For example, an enclosure may provide protection from water, humidity, wind, temperature, fire, radiation, electromagnetic interference, high voltage, physical damage or a combination thereof. In one or more embodiments, an enclosure may protect the components therein by providing a physical barrier to one or more hazards. It is noted that the enclosure is generally described herein with regard to a surveillance node. However, it is contemplated that the enclosure may be used with and benefit other surveillance hardware or devices.

[0155] An enclosure may also provide an environmentally controlled operating environment for a node's components. For example, an enclosure may control humidity, temperature, dust or other particulate concentrations, or a combination thereof for the components of a node. This is advantageous in that it provides an operating environment suited to the components. To illustrate, in one embodiment, the enclosure controls the temperature within a node to prevent temperatures that are excessively cold or excessively hot for the node's components.

[0156] FIG. 8A illustrates an exemplary embodiment of an enclosure 804 for a node 100. As shown, the enclosure 804 is rectangular in shape. It will be understood that the enclosure 804 may be various shapes in one or more embodiments. For example, the enclosure 804 may be square, round, rounded, or comprise a combination of various shapes. An enclosure 804 may also be various sizes. In one or more embodiments, the size of an enclosure 804 may be determined based on the components to be stored therein. The embodiment shown also includes a dome 808 for a camera. It is noted that a dome 808 may not be provided in embodiments without cameras.

[0157] The structure of an enclosure 804 may be formed from various materials. Typically, the enclosure 804 will be a rigid structure to allow the enclosure to support a node's components. For example, the enclosure 804 may be formed from one or more metals, alloys, plastics, carbon fiber, or a combination thereof. It will be understood that other suitable rigid materials may be used as well.

[0158] In addition, an enclosure 804 may be formed from materials configured or selected to protect a node's components. For example, one or more rigid materials, such as those described above, may be used to protect components from physical hazards such as but not limited to water, humidity, dust and other particulates, physical impact or force, or a combination thereof. It is contemplated that the enclosure 804 may be configured to withstand significant physical impacts in some embodiments. For example, the enclosure 804 may be bullet proof or fire resistant. In addition, an enclosure 804 may be formed from materials, such as metallic or insulating materials, that protect the components from other hazards such as but not limited to radiation, temperature, electromagnetic interference, and electrical charges.

[0159] In one or more embodiments, the enclosure 804 may be formed from a multi-layered material. A cross section of such a multi-layered material is illustrated in FIG. 8B. It is contemplated that an enclosure 804 may be formed from various rigid, insulating, protective and other layers of material. Each layer may have the same or a different thickness. It will be understood that the thickness of a layer may be selected based on the desired protective characteristics, rigidity, or both. For example, a thicker metal layer may provide increased rigidity. The exemplary embodiment of FIG. 8B illustrates an enclosure formed from a multi-layered material comprising a coating layer 816, an aluminum layer 820, an insulating layer 824, and a foil layer 828.

[0160] It will be understood that each layer of material may be included in an enclosure for one or more protective, insulating, or other characteristics of the material. In the exemplary embodiment of FIG. 8, the coating layer 816 may provide protection from UV light, provide some thermal insulation from external sources of heat, or both. The coating layer 816 may also protect other layers from oxidation and be various colors. It is contemplated that the coating layer 816 may be various paints or other coatings in one or more embodiments.

[0161] The aluminum layer 820 may provide electromagnetic shielding as well as provide a rigid physical structure to support components of a node and to protect such components from physical damage. The insulating layer 824 may be foam or other insulation that helps regulate temperature within the enclosure. Finally, the foil layer 828 may provide thermal insulation, electromagnetic shielding, or both.

[0162] It is noted that various portions, such as the chambers that will be described below, of an enclosure 804 may be formed from different layers, materials, or both. To illustrate, the enclosure 804 shown is formed from a two-layered material in one portion and a four-layer material in another portion. This is advantageous because it allows the enclosure 804 to provide protection suited to particular components. For example, certain components may not require as much or any thermal, electromagnetic, or other protection and thus the portion or portions of the enclosure 804 where these components are located may be formed from different materials or layers than other portions of the enclosure. This also prevents waste of materials because a layer of material may only be included when needed.

[0163] As illustrated in FIGS. 8A and 8D, an enclosure 804 may comprise one or more chambers. In general, the chambers allow one or more components of the nodes to be stored and protected therein. In one or more embodiments, one or more chambers may be sealed such that they are air tight, water tight, or both. This is advantageous in that a sealed chamber fully encloses the components therein and prevents infiltration of water, moisture, and dust and other particles. In addition, a sealed chamber allows a temperature range to be more easily maintained within the chamber because air of various temperatures cannot infiltrate the chamber. Each chamber may be formed from the same or different single or multi-layer materials.

[0164] As illustrated in FIG. 8C, a chamber may have one or more openings to allow electrical, optical, or other connectors 840 to accept an external connection. If desired (or required such as in the case of a sealed chamber), the connectors 840 may have a sealed bulkhead to prevent air, moisture, water, dust or other particles, or a combination thereof from infiltrating a chamber through the connectors. In general, a
sealed bulkhead allows a portion of an electrical, optical, or other conductor or connection to be externally accessible while preventing air or water infiltration by sealing the space around the conductor or connection. For example, in an electrical connector, any space around each electrical lead may be sealed or blocked by a portion of the connector such as the body of a connector.

[0165] In one or more embodiments, a chamber may also have one or more removable portions 812 to allow access to the components or parts within a chamber. It is contemplated that a removable portion 812 may be taken off a chamber to allow a technician or other person to access the inside of a chamber. This is advantageous in that such access allows components or parts to be repaired, replaced, updated, upgraded, removed, reinstalled, and the like. This also allows the inside of a chamber to be cleaned if needed or desired.

[0166] As can be seen in FIGS. 8A and 8C, the removable portion 812 may be a panel, door, or similar structure. The removable portion 812 may be secured to a chamber in various ways. For example, one or more fasteners, such as but not limited to screws, clips, clamps, pins, hook and loop, magnets, or a combination thereof may be used to secure the removable portion 812. In some embodiments, the removable portion 812 may be completely removable. For example, the removable portion 812 of FIG. 8A may be completely disconnected from an enclosure 804 by removing the screws. In other embodiments, the removable portion 812 may be partially removable. For example, the removable portion may be secured to an enclosure 804 by one or more hinges, slides, hooks, or the like.

[0167] The removable portion 812 may be formed from the same single or multi-layer material as its chamber. This allows the removable portion 812 to have the same protective characteristics as the remainder of the chamber. For example, the removable portion 812 may have the same or similar electromagnetic, heat, or other shielding as its chamber. In this manner, when the removable portion 812 is fastened or secured to the chamber, the components or parts within the chamber are protected as though the chamber did not have an opening. It is noted that the removable portion 812 may form an air or watertight seal in embodiments having sealed chambers. It will be understood that one or more gaskets or other seals may be used to form such a seal between a removable portion 812 and a chamber. If desired, one or more connectors may be secured to a removable portion 812 of a chamber.

[0168] In the embodiment of FIG. 8A, the enclosure 804 comprises two chambers, a component chamber 832 and a support chamber 836. In one or more embodiments, the component chamber 832 may contain components of the nodes as described above while the support chamber 836 may contain parts for regulating or controlling environmental factors within an enclosure 804 or portions thereof. The support chamber 836 may also provide power and other resources necessary to allow node components to operate properly.

[0169] As the cross section view of FIG. 8D shows, the support chamber 836 may be formed from a different multi-layer material than the component chamber 832. In the exemplary embodiment of FIG. 8D, the support chamber 836 is formed from a multi-layer material comprising a UV coating layer 816 and an aluminum layer 820 while the component chamber is formed from a multi-layer material comprising a UV coating layer, an aluminum layer, an insulating layer 824, and a foil layer 828. As can be seen, the support chamber 836 comprises vents 848 to allow the passage of air, while the component chamber 832 is sealed.

[0170] It is noted that an enclosure 804 may also provide one or more mounts 844, as shown in FIG. 8C, to allow the enclosure to be attached or secured to a wall, pole, or other structure. It is contemplated that various mounts 844 may be provided for various mounting applications.

[0171] The support chamber 836 will now be described with regard to FIG. 9. FIG. 9 is a cross section view of an exemplary support chamber 836 having parts for regulating or controlling the environment in and providing power to one or more component chambers 832 or other chambers.

[0172] Power may be provided via a power supply 920 within the support chamber 836. In one or more embodiments, a power supply 920 accepts power and converts it such as by raising or lowering the voltage/ampereage so that it is usable by the components or parts. The power supply 920 may also convert AC power to DC power and vice versa in some embodiments. It is contemplated that the power supply 920 may accept a wide range of input voltages and convert the same to usable voltages. In one embodiment, the input voltage acceptable to the power supply 920 is between 90-270VAC. The power supply 920 may be configured to operate in a wide range of environmental conditions such as in extremely cold or extremely hot environments, or in between.

[0173] The power supply 920 will typically, but not always, receive power from an external source such as a power grid. In embodiments where a node includes a power source for generating its own power, the features described above may be incorporated into the node's power source. Alternatively or in addition, a power supply 920 may be connected to a node's power source. It is noted that a node's power source may be located in a support chamber 836 in one or more embodiments.

[0174] The power supply 920 may be secured within a support chamber 836 in various ways. As shown in FIG. 9, the power supply 920 is mounted to a power supply mount 960 having a rigid structure which raises the power supply above the bottom of the support chamber 836. This allows cooling airflow to reach more of the power supply's surfaces to better cool the power supply. Of course, a power supply 920 may be secured in various other ways. For example, a power supply 920 may be secured directly to a portion of the support chamber 836 by one or more fasteners or structures.

[0175] The support chamber 836 and parts therein may be configured to control the environment of another chamber, such as a component chamber 832. In one or more embodiments, the environment may be controlled through various environmental control devices which control temperature, humidity, particulate concentration, or other characteristics of the air or other gas within an enclosure. For example, fans, refrigeration or other cooling devices, heating elements, heat sinks, thermal conductors, dehumidifiers, or a combination thereof may be used to control the environment within an enclosure. This is advantageous because sealed component chamber or other chamber may require a temperature controlled environment in one or more embodiments to prevent excessively hot or excessively cold temperatures from hindering operation of, damaging, or destroying components of a node. It is noted that the environment within the support chamber 836 may also be controlled by the support chamber in one or more embodiments.
In the exemplary embodiment of FIG. 9, the support chamber 836 comprises an airflow system and a thermal conductor 916 to control the environment of one or more chambers. In general, the thermal conductor 916 is a component which transfers heat from another chamber by conducting heat away from the other chamber. This allows the thermal conductor 916 to cool the other chamber. In general, the airflow system generates airflow to cool the thermal conductor 916. The airflow helps dissipate heat from the thermal conductor 916 allowing the thermal conductor to transfer heat more quickly.

The thermal conductor 916 may be configured in various ways. In one embodiment, the thermal conductor 916 may have a first portion for absorbing heat and a second portion for dissipating heat. Typically, the portion for absorbing heat will be in physical contact with the chamber the thermal conductor 916 is cooling. For example, the thermal conductor 916 may be in physical contact with a component chamber 832 to cool the component chamber. In one or more embodiments, the portion for absorbing heat may protrude into the chamber that is to be cooled, such as shown in FIG. 9. In this manner, heat may be absorbed from the chamber to cool the chamber.

To allow the thermal conductor 916 to protrude into a chamber, it is contemplated that a chamber, or a portion thereof, may have one or more openings. The chamber may form a seal around the thermal conductor if desired. In this manner, a sealed chamber can remain sealed even though the thermal conductor 916 protrudes into the chamber. In one embodiment, an opening large enough to accept a thermal conductor 916 may be provided. In other embodiments one or more openings large enough to accept one or more portions of a thermal conductor may be provided. For example, a thermal conductor 916 may be in two (or more) sections with first section being in the support chamber 836 and a second section in another chamber. The sections may be connected through one or more openings in a chamber by one or more fasteners such as screws or the like, one or more heat conducting materials, one or more heat pipes, or other members.

The thermal conductor 916 may be formed from materials, now known or later developed, which conduct heat. Typically, the materials with advantageous heat conducting properties will be used. For example, rigid materials, such as copper, aluminum, gold, steel, other metals, or a combination thereof may be used to form a thermal conductor 916. A thermal conductor 916 may include one or more heat dissipation fins, such as those found on heat sinks, at various locations to dissipate heat, absorb heat, or both. In addition, a thermal conductor 916 may include elements for liquid cooling. For example, the thermal conductor 916 may have one or more channels for liquid coolants. In one embodiment, the thermal conductor 916 includes one or more liquid filled heat pipes to transfer heat through the thermal conductor.

In one or more embodiments, the thermal conductor 916 may comprise an active or powered element for transferring heat from another chamber or to another chamber. For example, the thermal conductor 916 may comprise a Peltier device in one or more embodiments. Typically, the Peltier device will be oriented such that its cooler side is facing, in contact with, or inside the chamber to be cooled while its hotter side is within the support chamber 836. In this manner, heat may be absorbed by the cool side and dissipated in the support chamber 836. In addition, the cooler side of the Peltier device may be used to cool the support chamber 836 while the Peltier's hotter side is cooled by the support chamber 836. It will be understood that embodiments utilizing a Peltier device may include the dissipation fins, liquid cooling structures, heat pipes, heat sinks, or a combination thereof as described above. It is contemplated that the Peltier device may have one or more fans attached to its cool side to move cooled air within a chamber thereby cooling the components within such chamber.

As stated, the thermal conductor 916 (as well as other parts) may be cooled by the airflow system. The airflow system may be configured to ensure to reduce or eliminate degenerative airflows within a chamber. Generally, degenerative airflow is airflow that prevents the airflow system from accomplishing the desired results. Usually, degenerative airflows are created during an exception or problem condition. For example, a fan failure when two exhaust fans are used in parallel creates degenerative airflow because airflows may cycle from the failed fan to the operating exhaust fan directly without reaching the rest of a chamber or enclosure. In one embodiment, as will be described below, the airflow system utilizes fans positioned in series to prevent such an occurrence.

In general, the airflow system generates airflow between an air inlet 928 and an air outlet 932 of a support chamber 836. The inlet 928 and outlet 932 may comprise one or more openings, such as louvered or un-louvered vents 848, in the support chamber to allow the passage of air. In one embodiment, the inlet 928 and outlet 932 may be sized to regulate the air pressure within the support chamber 836. For example, the inlet 928 may be sized larger than the outlet 932 to allow more air to flow into the support chamber 836 than out. In this manner, a pressure head may be formed to ensure positive airflow within the support chamber 836. The positive airflow provides cooling and reduces or prevents a buildup of airborne particles inside the support chamber 836.

Airflow may be generated by various devices. For example, one or more fans, blowers, electrostatic air movers, or the like may be used to generate airflow. In one embodiment, the airflow system comprises a fan assembly 924 that generates airflow between the air inlet 928 and the air outlet 932. The fan assembly 924 itself may be configured in various ways. As shown in FIG. 9 for example, the fan assembly 924 comprises two fans 904 which are positioned in series by a spacer 912. In this configuration, the fans 904 are aligned in series by their axis of rotation. Typically, both fans 904 will spin in the same direction to generate airflow in the same direction. This allows each fan 904 to provide the same direction of airflow in case one fan fails.

Positioning of the fans 904 in series also ensures that no degenerative airflows are created by the failure of a fan. As can be seen, the failure of one fan 904 does not provide an alternate route through which a degenerative airflow can flow. This is because another fan 904 is positioned to prevent such degenerative airflow.

The spacer 912 may be configured as an open hollow structure having two open ends to which fans 904 may be attached. The spacer 912 may be sized such that the fans 904 are spaced apart to prevent shock waves from the fans' blades from negatively impacting the performance of the fans. For example, the spacer 912 may be sized based on the length, width, or other characteristic of a fan's blades to reduce or eliminate the impact of shock waves on fan performance. In one embodiment, the spacer 912 may provide an air tight seal between fans 904. This ensures airflow is directed where
desired. Spacing and sealing of the fans also ensures that the desired amount of backpressure (i.e., resistance to airflow) within the support chamber is maintained.

[0186] One benefit of a plurality of fans 904 is that failure of a single fan does not cause the entire airflow system to fail as one or more other fans may continue to move air. Of course, a single fan 904 or more than two fans may be used in some embodiments. Where a plurality of fans 904 are provided, the fans may be arranged such that they are aligned in series with one another, to ensure that a fan failure does not cause a degenerative airflow path. The positioning of fans in series causes the airflow generated by each fan 904 to be substantially in the same direction allowing one or more of the fans to provide the same direction of airflow in the event of a fan failure. A spacer 912 may be used to space a plurality of fans apart to compensate for shock waves such as described above. It is noted that the spacers 912 may be configured to form a seal to one or more fans 904. In this manner, airflow is efficiently directed between fans 904 because the airflow cannot be diverted through openings between a spacer 912 and a fan 904.

[0187] In one or more embodiments, the fan assembly 924 may be supported within a support chamber 836 by one or more mounts 908. The fan assembly 924 may also be supported by the support chamber 836 or a portion thereof as well. For example, a portion of the fan assembly 924 may be secured to the wall or other portion of a support chamber 836 by one or more fasteners, welds, clips, or the like. In these embodiments, a mount 908 may not be required.

[0188] The one or more mounts 908 may also be configured to form a seal around the fan assembly 924 in some embodiments. For example, one or more mounts 908 may seal a fan assembly 924 to the walls of a support chamber 836 in one or more embodiments. As shown in FIG. 9, the mounts 908 form a seal such that air from the inlet 928 must pass through the fan assembly 924 before moving further into the support chamber 836. This is advantageous in that it prevents unwanted airflow which may reduce the cooling efficiency of the airflow system. For example, without a seal around the fan assembly 924, air from within the support chamber rather than from the inlet 928 may be moved by the fan assembly. This may reduce the cooling efficiency of the airflow system because heated air may be recycled rather than exhausted out of an air outlet 932.

[0189] The airflow system may also comprise one or more baffles 936 in some embodiments. The baffles 936 may be configured to create turbulence as desired in the airflow created by the airflow system. As shown in FIG. 9, a baffle 936 extends upward from the bottom of the support chamber 836 near the outlet 932.

[0190] In operation, the airflow system generates airflow to cool parts of the support chamber 836 such as the thermal conductor 916. As shown by the arrows of FIG. 9, the generated airflow flows around and, in some cases, through the thermal conductor 916 allowing the thermal conductor to better dissipate heat by pushing heat out of the support chamber's air outlet 932. It will be understood that other parts in the support chamber 836 may be cooled by the airflow system. For example, the power supply 920 may be cooled by the airflow from the airflow system. It is noted that the arrows indicating airflow are exemplary and that various other airflows may be provided according to the invention.

[0191] FIG. 9 also illustrates how components and capture devices of a node may be arranged within a component chamber 832. In the embodiment shown, the capture device is a camera 948 which captures images through a dome 808. The other components 956 may be various devices such as one or more processors and transceivers which make up a node, as described above. For example, the component chamber 832 may have one or more microprocessors, cellular transceivers, and wireless 802.11 transceivers therein.

[0192] The components 956 may be mounted within a component chamber 832 in various ways. As shown, the components 956 are attached to cards 948. The cards 948 provide the advantage of allowing cards 948 and their attached components 956 to be quickly and easily removed and installed. In one embodiment, the cards 948 slide into guides 944 having a channel configured to accept the edge of a card. In this manner, cards 948 may slide into place. Once in place, the cards 948 may be secured by a locking pin 952 or other fastener if desired. In one embodiment, the locking pin passes through an opening of a guide 944 and a card 948 to secure the card in place. It is contemplated that the locking pin 952 may also secured a card frictionally. In this case, the card itself may not provide an opening.

[0193] The component chamber 832 itself may include one or more fans 904 in some embodiments. The fans 904 may be configured to provide additional airflow within the component chamber 832 if desired. Generally, this additional airflow allows for more efficient temperature regulation within the component chamber 832. The fans 904 may be pointed in different directions to circulate air within the component chamber 832. In the embodiment of FIG. 9 for example, the fans may be pointed in opposite directions to generate a generally circular airflow within the component chamber as illustrated by the arrows. Of course other airflow may be provided according to the invention. It can be seen that the airflow transfers heat to and/or is cooled by the thermal conductor 916 as it contacts the thermal conductor. In this manner, the temperature within the component chamber 832 may be controlled.

[0194] It is contemplated that the environmental control features of the support chamber 836 may be controlled by a control system in one or more embodiments. For instance, the control system may control operation of the fan assembly 924, thermal conductor 916, power supply 920, and other parts of the support chamber 836.

[0195] FIG. 10 illustrates a block diagram of an embodiment of a control system. As shown, the control system comprises a controller 1004 and one or more sensors 1008. As will be described further below, the sensors 1008 may be various devices capable of detecting environmental or other conditions inside a chamber or enclosure or outside a chamber or enclosure. The controller 1004 may be connected, such as by an electrical, optical, or wireless connection, to the sensors 1008. The controller 1004 may also be connected to parts of the support chamber 836 as well to allow the controller to control their operation. As shown in FIG. 10, the controller 1004 is connected to the fans 904 of an airflow system and a power supply 920 to control their operation. It will be understood that the controller 1004 may be connected to airflow systems comprising devices other than fans in one or more embodiments.

[0196] The controller 1004 may be a microprocessor, microcontroller, or other circuit in one or more embodiments. The controller 1004 may be hardwired to control parts of a support chamber 836 or may execute machine readable code from a memory to do the same. It is contemplated that the
controller 1004 may also control cooling or other temperature control devices within a component chamber as well.

[0197] In one embodiment, the controller 1004 receives sensor information from the one or more sensors 1008 and controls parts of a support chamber 836 accordingly. The controller 1004 may also receive operating information from such parts as well. As used herein, sensor information will refer to information generated from a sensor. As used herein, operating information will refer to information regarding the operational characteristics of a part of the support chamber 836. For example, operating information may include the current temperature, voltage, fan speed, status, and any error conditions for a component or part. The controller 1004 will generally be configured to ensure that the support chamber’s temperature is within range of equipment specifications prior to applying external power. In some embodiments, the controller may directly receive external power and not be dependent upon the support’s chamber power system to operate.

[0198] The sensors 1008 will generally be configured to detect various environmental conditions and send sensor information comprising the same to the processor. For example, the sensors 1008 may detect temperature, humidity, and airborne particulate concentration. One or more sensors 1008 may be located in various chambers or even outside the enclosure to detect environmental conditions. In addition, sensors 1008 may be located on or near various components or parts of a node to detect their temperature.

[0199] Based on the sensor information, the controller 1004 may adjust the operation of one or more parts of the support chamber 836. For example, the controller 1004 may adjust the speed of the fans 904 in a fan assembly 924, the cooling provided by the thermal conductor 916, or both to maintain a temperature or temperature range. In one embodiment, the controller 1004 may also increase or decrease fan speed, cooling (such as provided by a Peltier device), or both to maintain a temperature or temperature range inside a component chamber.

[0200] In an embodiment where the thermal conductor 916 comprises a powered element, such as a Peltier device, the controller may activate and deactivate the Peltier based on temperature information within the support chamber, the component chamber or both. For instance, if the temperature of a component chamber or device therein is below a certain threshold the controller 1004 may deactivate a thermal conductor 916 by turning off or removing power from the thermal conductor. Where the temperature is above a certain threshold, the controller 1004 may activate the thermal conductor 916 by turning on or providing power to the thermal conductor. Since there is a temperature difference between the outside and inside of a sealed component chamber, the heat given off by the chamber’s components ensure components in the sealed chamber will operate in a predetermined temperature range as balanced by the cooling provided by a thermal conductor 916, such as a Peltier device.

[0201] The controller 1004 may also adjust operation of a power supply 920 or power isolation system in one or more embodiments. For example, the controller 1004 may turn off power to one or more components or parts where their temperature, as determined by one or more sensors 1008, is high enough or low enough to damage or destroy the components or parts. The controller 1004 may also turn off one, some, or all the components of an component chamber if temperatures within the component chamber would damage or destroy the components therein.

[0202] The controller 1004 may also respond to operating information from one or more parts of a support chamber 836. For example, the controller 1004 may detect the speed of one or more fans 904 and increase or decrease fan speed to maintain a desired temperature. In addition, the controller 1004 may activate or increase speed of one or more fans 904 in response to operating information indicating the failure of one or more other fans. This allows the airflow system to continue to operate even though one or more fans 904 have failed. In the event a fan assembly 924 completely fails, or insufficient airflow is being provided, the controller 1004 may cause the power supply 920 to turn off one or more components of a node to prevent damage. Likewise, the controller may respond to operating information from the thermal conductor 916. For example, if the thermal conductor 916 is not operating normally, the controller 1004 may increase the fan speed of one or more fans 904 to compensate. In addition, the controller 1004 may increase cooling provided by the thermal conductor 916, such as a thermal conductor including a Peltier device, in response to abnormal operation of a fan assembly 924. It is noted that operating information may also be received by other components or parts within an enclosure. For example, the status of one or more capture devices, transceivers, and other components may be received.

[0203] The control system may include or be connected to a transceiver 1012 in one or more embodiments to communicate with remote devices, such as through a network or other connection. As described above, a transceiver may allow wired or wireless communication. The controller 1004 may utilize the transceiver 1012 to communicate status information regarding functional or environmental aspects of the system. For example, the controller 1004 may communicate fan speed(s), temperatures, humidity, error conditions, and other information to a remote device. In this manner, the operation of the control system and the node itself may be monitored/diagnosed remotely. It is contemplated that the controller 1004 may also receive instructions or updates via the transceiver 1012. For example, firmware, software, or configuration updates may be received. In addition, instructions such as power on, power off, reset, or reboot instructions may be received.

[0204] The control system may also include or be connected to a heating element 1016 in one or more embodiments which generates heat to warm a chamber, component, or part therein. For example, a heating element 1016 may be used to warm a support or component chamber or their respective parts/components. The heating element 1016 is beneficial especially in cold environments to ensure that components or parts of a node are not damaged or destroyed by cold. In one or more embodiments, the heating element 1016 may be used to warm up components or parts of a node prior to turning them on. This prevents damage to the components or parts caused by starting them in a cold or very cold temperature. Once the components or parts are on, they may generate their own heat and the heating element 1016 may be shut off.

[0205] Alternatively, the heating element 1016 may remain on to warm the components or parts if necessary. Placement of a heating element 1016 may be determined on environmental conditions and operating conditions of the components or parts. In one or more embodiments, a heating element 1016 will be placed next to or in contact with the component or part to be warmed. The heating element 1016 may be any device, now known or later developed, configured to generate
heat as described herein. Typically, the heating element 1016 will be an electrical heating element.

[0206] In one embodiment, the controller 1004 may utilize sensor information or operating information to determine when and a heating element 1016 should be activated. The controller 1004 may also control the amount of heat generated by the heating element 1016. When turning on a node, it is contemplated that the controller 1004 may delay turning on one or more components or parts until their temperatures are above a certain threshold. For example, the controller 1004 may prevent power from being supplied through the power supply to a component or part if temperatures are too low. This prevents the components or parts from being damaged. At any time, the controller 1004 may also turn off power from the power supply if temperatures are too low. Alternatively, or in addition, the controller 1004 may activate a heating element 1016 if temperatures are too low.

[0207] It is contemplated that the enclosure may be configured for mobile applications in one or more embodiments. For instance, a mobile enclosure may both protect and support surveillance components or devices such as described above. In addition, the mobile enclosure may include aspects to provide such protection and support suited for situations or environments where surveillance device are mobile or moved around. Further, as described herein, the mobile enclosure may be sealed to provide a desirable or optimized environment for electronic or other surveillance hardware/components.

[0208] Mobile surveillance is highly desirable in that it provides an additional perspective or view point from which surveillance information (e.g., images, sounds, videos) may be captured. As its name implies, mobile surveillance also may be moved to various locations quickly and easily. In addition, in some cases, mobile surveillance may be the only surveillance available. For example, a video camera in a police car or other vehicle may be the only surveillance available during a traffic stop or the like.

[0209] Use of surveillance devices in mobile applications may require specialized hardware, such as ruggedized hardware or the like, to help ensure that the surveillance devices perform as desired, are reliable, and are not damaged when used or moved in mobile applications. Depending on the use, some of the motions encountered by mobile surveillance devices may be jarring and disrupt or damage the surveillance gathering capability of the devices. This is highly undesirable especially where the disruption or damage causes crucial surveillance to not be captured and recorded. In addition, mobile use typically requires smaller sized equipment. In small or confined spaces, heat dissipation must be controlled to prevent damage to hardware components. Moreover, it is important to provide reliable power sources while reducing power utilization in mobile applications.

[0210] As will be described further below, the mobile enclosure herein has unique characteristics that can be used to address these issues. For example, in one or more embodiments, the mobile enclosure provides multi-stage vibration dampening to reduce or eliminate physical shocks or motions to surveillance device components, a tuned environmental control system to control the environment within the enclosure, and a reconstituted power isolation system to provide reliable power while reducing power requirements. Of course, various embodiments of the mobile enclosure may include one or more of these features depending on the mobile application or as desired. It will be understood that these features may also be used or implemented in non-mobile or fixed enclosures as well in some embodiments.

[0211] FIGS. 11A-11B illustrate an exemplary mobile enclosure 1104 that may be used for mobile applications. As can be seen, the mobile enclosure 1104 may be rectangular in shape. Of course, other shapes may be used. The mobile enclosure 1104 may also be a variety of sizes. Typically, the mobile enclosure 1104 will have a smaller size than that of fixed or immobile embodiments. This allows the enclosure 1104 to be mounted within or to vehicles or other mobile platforms and allows the enclosure to be easily moved.

[0212] The mobile enclosure 1104 may comprise one or more chambers which hold or enclose various components. These chambers may be formed from a variety of materials. For instance, as described above, one or more chambers of the mobile enclosure 1104 may have a structure comprising one or more materials in some embodiments. In other embodiments, the chambers of the mobile enclosure 1104 may comprise a multi-layer material such as described and illustrated in FIG. 8B. The chambers may be formed from a single or multi-layer material depending on the amount or type of protection the chamber or enclosure is designed to provide.

[0213] As with the above-described enclosures, the chambers may be sealed to prevent infiltration of physical objects, dust, water, moisture, contaminants, electromagnetic or other radiation, heat, cold, or other undesirable elements into the mobile enclosure where they may be harmful to internal hardware. The chambers of the mobile enclosure 1104 itself may also be configured to withstand physical impacts.

[0214] As will be described further below, in multi-chamber embodiments, the mobile enclosure 1104 may have one or more support chambers, one or more component chambers, or both. In some embodiments, the mobile enclosure 1104 may have a single chamber design. For example, the mobile enclosure 1104 may only have a component chamber. This is advantageous in that it reduces the size of the enclosure 1104 for mobile uses. Of course, the mobile enclosure 1104 may also have a support chamber in some embodiments.

[0215] To allow connectors 840 of various types to be accessible, the mobile enclosure 1104 may comprise one or more openings. In some embodiments, the connectors 840 may extend outward from the enclosure to allow for easier access. In other embodiments, the connectors 840 may be flush or inset into the enclosure 1104. As described above, the connectors 840 may be sealed such that they are water or weather proof resistant. In this manner, the internal components of the mobile enclosure 1104 can be protected from moisture, dust, or other undesirable elements which would otherwise enter the enclosure. Moreover, the seal also allows the enclosure 1104 to better control the environment within the enclosure by limiting outside air infiltration that may bring undesirable temperature changes, humidity, or the like into the enclosure.

[0216] As can be seen a variety of connectors 840 may be provided. In the embodiment shown, various power, network, antenna, audio, video, and console connectors 840 are provided. Of course, additional or fewer connectors 840 may be provided in one or more embodiments. The enclosure 1104 also includes a power indicator 1112 to notify users that the surveillance device is on. Of course, other information such as error states or status may be conveyed by the power indicator 1112 as well.

[0217] The vibration dampening system will now be described. In general, the vibration dampening system
reduces or eliminates physical shocks, movements, vibrations, or a combination thereof. In one or more embodiments, the vibration dampening system may be configured as a multi-stage system where multiple independent dampening assemblies are used to reduce or eliminate shock, movement, and/or vibration. In other embodiments, a single-stage system having a single dampening assembly may be utilized. Vibration dampening may occur by isolating movement or vibration of one portion of the enclosure from other portions of the enclosure. This may be accomplished with a variety of vibration absorbing materials, structures, or both as will now be described.

[0218] As shown in FIGS. 11A-11B, the mobile enclosure 1104 may be mounted to a surface or other structure by one or more mounts 1116. For instance, the mount 1116 may be an “L” shaped bracket attached to the enclosure 1104. The mount 1116 may include one or more openings 1120 to allow for attachment to another structure or surface. It will be understood that a mount 1116 may attach to another structure or surface in a variety of ways. For example, one or more clips, clamps, screws, or the like may be used to attach the mount 1116.

[0219] In one or more embodiments, the one or more mounts 1116 may provide vibration dampening in addition to attaching the mobile enclosure 1104 to a structure or surface. This may be accomplished through one or more vibration isolators 1204. In general, a vibration isolator 1204 prevents direct physical contact between two structures while allowing the structures to be held in place relative to one another. In this manner, transfer of vibration may be reduced or eliminated by the vibration isolator 1204 while having various structures of the enclosure 1104 in place.

[0220] FIG. 12A illustrates an exemplary vibration isolator 1204. As can be seen, the vibration isolator 1204 comprises a dampener 1208 and an attachment member 1212. The dampener 1208 may be a flexible or resilient material to absorb vibration. In this manner, vibration (or other movement) of one structure is at least partially absorbed by the dampener 1208 before it reaches the other structure. A dampener 1208 may be used to mount individual components of a surveillance device or multiple components, as will be described below.

[0221] The dampener 1208 may be constructed from a variety of materials. Typically the material or materials used will be flexible or resilient to allow the dampener 1208 to absorb vibration or motion. For example, the dampener 1208 may be rubber or plastic in some embodiments. It is contemplated that the dampener 1208 may be more rigid or less rigid depending on the amount of vibration or movement expected to be encountered. In one embodiment, dampeners 1208 reduced rigidity may be used where there is an increased or high level of vibration, while more rigid dampeners may be used where there is a reduced or low level of vibration.

[0222] As can be seen in FIG. 12B, a first portion of the dampener engages a first structure, while a second portion of the dampener engages a second structure. This prevents direct physical contact between the two structures and allows vibration or movement of one structure to be isolated from that of another structure. In FIG. 12B, an outer portion of the dampener engages the mobile enclosure 1104 while an inner portion engages the mount 1116. When held in place by the attachment member 1212, the enclosure 1104 and mount 1116 contact the dampener 1208 but not one another.

[0223] In some embodiments, the dampener 1208 may include an opening to allow the attachment member 1212 to pass therethrough. This allows the attachment member 1212 to contact the enclosure 1104 and thus hold the mount 1116 in place relative to the enclosure. As shown in FIG. 12B for instance, the attachment member 1212 comprises a screw which is screwed into the enclosure 1104 through an opening in the mount 1116 and the dampener 1208. As the screw is tightened, the head of the screw holds the mount 1116 in contact with the dampener 1208 and in place relative to the enclosure 1104.

[0224] In one or more embodiments, a multi-stage or multi-part vibration dampening system may be employed. For example, as shown in FIG. 12C, the mobile enclosure 1104 may have one or more vibration dampening assemblies 1216A, 1216B, 1216C where vibration may be absorbed to prevent transfer of the vibration to electronic or other components within the enclosure. In the embodiment of FIG. 12C, a 3-stage vibration dampening system is used, with each “stage” (i.e., dampening assembly) being used to absorb some of the vibration or movement at various areas or sections of the enclosure 1104. It will be understood that fewer or additional stages or parts of the enclosure 1104 may include vibration dampening in one or more embodiments. For example, it is contemplated that individual electronic components may be attached to a dampening assembly if desired.

[0225] A dampening assembly may be configured in a variety of ways. Typically, the dampening assembly will include a support structure to which various hardware components may be mounted, and one or more dampening materials or structures (e.g., vibration isolators or dampeners) which allows the dampening assembly to be attached or mounted to the enclosure in a manner that reduces or prevents the transfer of vibration to or from the assembly. In this way, the hardware components mounted to the dampening assembly’s support structure are protected from vibration. It is noted that the support structure may be a rigid structure, such as a plate, bracket, or the like. In addition, the support structure may be another component of the mobile enclosure or surveillance device. For example, as will be described below, a support structure may be a heat dissipater or thermal conductor plate of the mobile enclosure 1104 to which various hardware components may be mounted. The dampeners may be temperature specific.

[0226] A first stage dampening assembly 1216A may be provided as a structure for attaching the enclosure 1104 to a surface. For example, as shown, the mounts 1116 (i.e., support structures) are attached to the enclosure 1104 via a plurality of vibration isolators 1204. It is noted that vibration isolators 1204 may alternatively or additionally be used to attach the mounts 1116 to a surface. As can be seen, the first stage dampening may be “external” to the enclosure. This is beneficial in that such dampening may be used to prevent or reduce vibration or movement of the entire enclosure 1104. Thus, all components of a surveillance device may be protected in this manner.

[0227] As will be described further below, in one or more embodiments, one or more components of the enclosure 1104 (such as an environmental control system) may be mounted externally or at least partially external to the enclosure. For instance, a component may be mounted externally to or extend outward from a chamber, such as a component or support chamber, of the enclosure 1104. Though such components may only be partially external to a chamber (i.e., a
portion of the component may extend into a chamber), they will be referred to herein as external components.

[0228] Vibration dampening may be employed with regard to external components in one or more embodiments. This is beneficial because vibration or other movement is reduced or eliminated relative to such components. In general, a vibration dampening material or structure may be used to accomplish this dampening.

[0229] To illustrate, FIG. 12C shows second stage damping assembly 1216B used to mount a heat dissipater 1220 at the bottom of the enclosure 1104. As can be seen, the heat dissipater 1220 has been mounted with one or more vibration isolators 1204. In this manner, vibration or other movement is not transferred from the enclosure to the heat dissipater 1220, and vice versa. It is noted that in some embodiments, the enclosure or an external component may include mechanical parts which generate vibration, such as fans and the like. For example, the heat dissipater 1220 shown has a fan assembly 924 (attached via a thermal conductor 916) which may generate vibration or movement. The vibration dampening of external components is highly beneficial in that it isolates both vibration from the environment as well as vibration from a component of the enclosure.

[0230] The enclosure 1104 may also include internal dampening as will now be described. In general, such dampening may be accomplished by mounting interior components or sections to the enclosure 1104 with one or more damping structures or materials, such as the dampeners 1208 described above. For example, in FIG. 12C, a third stage dampening assembly 1216C is shown at the top of the enclosure 1104 and used to mount a thermal conductor plate within the enclosure.

[0231] In this embodiment, it can be seen that the thermal conductor plate 1224 forms a support structure of the third stage dampening assembly 1216C. As shown, the thermal conductor plate 1224 is mounted by vibration isolators 1204, and various hardware components are in turn mounted to the thermal conductor plate. In this manner, the third stage dampening assembly 1216C prevents or reduces vibration for various internal components of a surveillance device.

[0232] Though illustrated with internal and external vibration dampening, it is contemplated that, in some embodiments, only internal vibration dampening will be provided, while in other embodiments, only external vibration dampening may be provided. For example, in one embodiment, the mobile enclosure 1104 may utilize only an external dampening assembly such as the bracket-type assembly described above. In this and similar embodiments, internal structures and components may be rigidly mounted, such as by one or more standard fasteners (e.g., screws, rivets, clips, welds, etc. . . ).

[0233] Like the enclosures described above, the mobile enclosure 1104 may also provide environmental control and protection for hardware components via an environmental control system. For instance, the mobile enclosure 1104 may control the temperature, humidity, or other environmental characteristic within the enclosure. As stated, this is beneficial in that it allows the hardware components to operate at a desired or optimized temperature which may be determined based on the specifications of the components.

[0234] In mobile embodiments, a reduced size may be highly advantageous in that smaller sized enclosures are more easily installed and moved in mobile applications. The size reduction may be accomplished in various ways. For example, a reduced sized support chamber may be used to reduce the size of the mobile enclosure 1104. In these embodiments, the environmental control components or system of the support chamber may be configured to operate within a support chamber of reduced size, such as a form fitting support chamber. In other embodiments, the environmental control components or system may be configured to operate without the need to be enclosed in a support chamber to further reduce the size of the mobile enclosure 1104.

[0235] FIG. 13A illustrates an exemplary mobile enclosure 1104 comprising a component chamber 832 coupled with an environmental control system 1304. As can be seen, the component chamber 832 provides an enclosed compartment for one or more hardware components. The environmental control system 1304 shown generally provides environmental control, such as temperature control, without the need for a support chamber.

[0236] The environmental control system 1304 may be configured in a variety of ways. In one or more embodiments, the environmental control system 1304 may comprise a thermal dissipater 1220, a thermal conductor 916, a fan assembly 924, or a combination thereof. It will be understood that the environmental control system 1304 may comprise more than one of each of these components. In addition, it will be understood that more than one environmental control system 1304 may be used with a mobile enclosure 1104. For example, an environmental control system 1304 may be used at the top and bottom of the mobile enclosure 1104.

[0237] As can be seen, the thermal conductor 916 may extend from the thermal dissipater 1220 to the component chamber 832. In some embodiments, the thermal conductor 916 may extend a distance into the component chamber 832. In such embodiments, an opening in the component chamber 832 may be provided, or the thermal conductor 916 may comprise one or more sections, one of which is located in the component chamber. In any case, it is contemplated that the component chamber 832 may maintain its seal, such as described above, despite the presence of the thermal conductor 916 within the chamber.

[0238] In general, the thermal conductor 916 transfers heat away from the component chamber by conducting the heat away from the component chamber. The thermal conductor 916 may be configured in a variety of ways, as has been described above. In one embodiment, the thermal conductor 916 may comprise or be configured as a Peltier device with its cold side oriented towards, in contact with, or inside the component chamber 832. One advantage of a Peltier device is that it may be tuned to particular environments and conditions. For instance, a controller or the like of the enclosure 1104 may control the output of the Peltier device based on current environmental or other conditions, as may be detected by one or more sensors or the like. This optimizes the operation of the environmental control system 1304 and allows reduced power consumption and thermal loss, which is highly advantageous in mobile applications where power may be a limited resource.

[0239] In general, the thermal dissipater 1220 transfers thermal energy (i.e., heat) from a source to the environment. In this manner, heat from the mobile enclosure 1104 may be dissipated with the thermal dissipater 1220. The heat source may be various components within the enclosure 1104. In one embodiment, one heat source (or the only heat source) for the thermal dissipater 1220 may be the thermal conductor 916. For example, the thermal conductor 916 may absorb heat from the component chamber 832 and transfer the heat to the
thermal dissipater 1220 in one or more embodiments. In embodiments where the thermal conductor 916 includes a Peltier device, the hot or heated end of the Peltier device may be in contact with the thermal dissipater 1220 to allow dissipation of the heat generated by the Peltier device.

[0240] It is noted that, as shown in FIG. 13A, a portion of the thermal conductor 916 may be embedded in the thermal dissipater 1220 in some embodiments. Embedding a portion of the thermal conductor 916 into the thermal dissipater 1220 is advantageous in that it increases the contact surface area between the thermal conductor and the thermal dissipater. This increases the amount of heat that can be transferred. The thermal conductor 916 need not be embedded in all embodiments however. It is contemplated that the environmental control system 1304 may operate with the thermal conductor 916 in contact with the thermal dissipater 1220, rather than embedded in the dissipater.

[0241] An airflow system may be coupled with the thermal conductor 916 in one or more embodiments. For example, as shown, the mobile enclosure 1104 includes a fan assembly 924 adjacent to the thermal conductor 916 to provide at least one airflow within the component chamber 832. The location of the fan assembly 924 may vary. In the embodiment shown, the fan assembly 924 is near or attached to the thermal conductor 916 to draw cool air from the thermal conductor and move the cooled air within the component chamber 832. The air flow(s) generated by the fan assembly 924 help ensure the desired amount of cooling is provided to various components within the enclosure 1104. It is noted that, like some thermal conductors 916, the operation of the airflow system (e.g., fan assembly) may be adjusted to suit various conditions. For example, airflow may be reduced, by a controller or the like, for cooler temperatures inside or outside of the mobile enclosure 1104, and/or may be increased for warmer temperatures inside or outside the enclosure. This provides optimized operation with reduced energy consumption, which is highly advantageous for mobile applications where power may be a limited resource.

[0242] It is noted that a support chamber 836 may be provided in some embodiments, such as shown in FIG. 13B. As can be seen, the support chamber 836 may enclose the environmental control system 1304 or a portion thereof. The support chamber 836 may be configured in various ways, such as described above, and may include various structures such as baffles, vents, seals, and the like to control airflow within the support chamber.

[0243] For example, the support chamber 836 may comprise one or more vents 848 to allow the movement of air through the support chamber. This allows heat from the heat dissipater 1220 to be dissipated into the environment. In some embodiments, an airflow system may be provided in the support chamber 836 to assist with heat dissipation by increasing airflow to the heat dissipater 1220. For instance, a fan assembly 924 such as shown in FIG. 13B may be provided to increase airflow. The fans of the fan assembly 924 or the fan assembly 924 itself may be sealed to the walls of the support chamber 836 in one or more embodiments.

[0244] The environmental control system will now be described in further detail with regard to FIGS. 13C-13D. FIG. 13C provides a perspective view of an exemplary environmental control system 1304 while FIG. 13D provides a cross sectional view. As shown, the environmental control system 1304 comprises a heat dissipater 1220 configured as a heat dissipation plate 1308 having one or more dissipation fins 1316 to increase its surface area and aid in transferring heat from the heat dissipater.

[0245] Though shown as a planar structure, it is contemplated that the heat dissipater 1220 may be various shapes and various sizes. For example, the heat dissipater 1220 may incorporate one or more bends or curves that may be used to allow the heat dissipater to conform to or wrap around the exterior of a mobile enclosure 1104. This allows the heat dissipater 1220 to have an increased size which improves its ability to dissipate heat into the environment. It is noted that in some embodiments, some or all of the heat dissipater 1220 may not be in direct contact with the mobile enclosure 1104 to further prevent heat from the heat dissipater from re-entering the mobile enclosure. For example, the heat dissipater 1220 may be sized or shaped such that there is a gap between the exterior of the mobile enclosure and the heat dissipater.

[0246] The heat dissipater 1220 may also comprise one or more thermal isolation materials 1312 to prevent heat from being dissipated back into or towards the component chamber. In general, the thermal isolation materials 1312 reflect heat away from the component chamber. In one or more embodiments, the thermal isolation materials 1312 may be planar in shape, or may be one or more coatings applied to the heat dissipater 1220. Thus, the thermal isolation materials 1312 may be in a sheet or layer type configuration.

[0247] The thermal isolation materials 1312 may be a variety of insulating materials and/or structures. For example, the thermal isolation materials 1312 may comprise foam, honeycomb structures, natural and synthetic materials, Delrin (Trademark of DuPont), and the like.

[0248] As can be seen from FIG. 13D, the thermal isolation materials 1312 may have an opening 1344 to allow a thermal conductor 916 to directly contact the thermal dissipater 1220. In this manner, heat from the thermal conductor 916 may be efficiently transferred to the thermal dissipater 1220.

[0249] FIG. 13D also shows multiple layers of thermal isolation materials 1312A, 1312B, 1312C. It is noted that only a single layer may be provided in some embodiments. In multiple layer embodiments, the layers may comprise different materials, if desired. For example, a first layer of isolation material 1312A may be a lower density material, such as low density insulation, while a second layer of isolation material 1312B may be a higher density material, such as high density insulation. A third layer of isolation material 1312C may be a thermal reflection material, such as a foil layer or coating. Of course, more layers than shown in FIG. 13D may be provided in one or more embodiments.

[0250] In FIGS. 13C-13D, the thermal isolation materials 1312 are shown as part of the environmental control system 1304. It is noted however, that in one or more embodiments, the isolation materials may not be provided. Alternatively, the isolation materials may be part of a support chamber, or a portion of the support chamber may perform the function of the isolation materials. For example, referring to FIG. 13A, the support chamber may comprise a multi-layer material which has an opening to allow a thermal conductor 916 to pass through a wall of the support chamber. As discussed, the multi-layer material of the support chamber may provide insulation or other thermal isolation. In this manner, the multi-layer material adjacent the thermal dissipater 1220 may perform the function of the thermal isolation materials. Of course, both the multi-layer material and thermal isolation materials may be used in one or more embodiments.
Thermal isolation of the heat dissipater 1220 is highly advantageous in that it guides thermal energy or heat from its source to the heat dissipater 1220. In this manner, the heat is directed away from the component chamber 836 and to the heat dissipater 1220 where it may be released to the environment. Referring to FIG. 13D for example, the heat from the thermal conductor 916 is directed to the heat dissipater 1220 through direct physical contact with the heat dissipater. The thermal isolation materials 1312A, 1312B, 1312C which surround the connection between the thermal conductor 916 and the heat dissipater 1220 help prevent heat from escaping into the component chamber.

The connection between the heat dissipater 1220 and thermal conductor 916 will now be described. In general, the heat dissipater 1220 and thermal conductor 916 will be connected by direct physical contact. One or more compounds, such as thermal grease, may be used to increase the efficiency of heat transfer at the connection point, if desired.

As described above, a thermal conductor 916 may absorb or receive heat at one end and transfer or release the heat at another end. As illustrated in FIG. 13D for example, the thermal conductor 916 may comprise a receiving end 1324 and a release end 1328. In embodiments where the thermal conductor 916 is configured as a Peltier device, the receiving end 1324 may be a cooled end or plate while the release end 1328 may be the heated end or plate of the Peltier device.

The release end 1328 may be in direct contact with the heat dissipater 1220 in one or more embodiments. Alternatively, a heat transfer element 1336 may be used to connect the release end 1328 with the heat dissipater 1220. This is beneficial in that it allows the release end 1328 to be a further distance away from the heat dissipater 1220. For example, there may be several layers of thermal isolation material 1312 and/or a chamber wall that may need to be spanned in order for the release end 1328 to contact the heat dissipater 1220. This is also beneficial in that it allows the receiving end 1324 to be positioned closer to a component chamber or even within the component chamber.

In general, the heat transfer element 1336 will be formed from materials which conduct heat efficiently. For example, one or more metals may be used to form a heat transfer element. The heat transfer element 1336 may also be various structures. For example, the heat transfer element 1336 may be a heat pipe in some embodiments. It will be understood that a single heat transfer element 1336 may be used such as shown in FIG. 13D, or multiple heat transfer elements 1336 may be used. It is noted that in one or more embodiments, the heat transfer element 1336 may be integrally formed with the heat dissipater 1220, the thermal conductor 916, or both. Thermal grease or other compounds may be used to aid the transfer of heat to and from the heat transfer element 1336.

The environmental control system may comprise additional elements in one or more embodiments. In general, these elements will be used to control environmental conditions within a component chamber, such as temperature. For example, the environmental control system may include one or more baffles, guides, or additional fans/fan assemblies to guide/provide air flow within the component chamber. The environmental control system may also include a control system, such as described with regard to FIG. 10, to control its operation. One or more sensors may be provided to complete a feedback loop to control the internal environment of the mobile enclosure.

As another example, one or more external fans may be included in one or more embodiments, such as shown in FIG. 13E. In some situations a thermal barrier created by the heat transfer process may form around the heat dissipater 1220. This reduces the ability for the heat dissipater 1220 to transfer heat to the environment. The external fans 1348 may be used to break the thermal barrier by generating air flow. As shown in FIG. 13E, there may be redundant external fans 1348 in case one fan is damaged. It is noted that some embodiments may only include a single external fan 1348.

It is contemplated that only a small amount of air flow may be necessary. For example, 1 to 2 CFM may be enough to break a thermal barrier. Thus, the external fans
The external fans 1348 may be configured to run continuously or to start and stop depending on environmental conditions. For example, the external fans 1348 may run when a thermal barrier is detected, such as by detecting increased temperatures at the heat dissipator 1220. When or if the thermal barrier dissipates, the external fans 1348 may then stop. To illustrate, in high humidity situations where it is more difficult for thermal barriers to form, the external fans 1348 may cease their operation. It is contemplated that the external fans 1348 may be controlled by a control system. One or more sensors of the control system may be used to detect conditions which would start, stop, increase, or decrease the operation of the external fans 1348. It is noted that in high humidity environments, external fans 1348 may run only occasionally, if at all. Thus, in some embodiments, external fans 1348 may not be required or provided.

External fans 1348 may be mounted in a variety of ways. FIG. 13E illustrates one such mounting. As can be seen one or more portions of the dissipation fans 1316 may be removed to provide a space for the external fans 1348. In this manner, the external fans 1348 may be inset to form any thermal barrier surrounding the heat dissipator 1220. The external fans 1348 may be used to mount the dissipation fans 1316 to one or more embodiments. The external fans 1348 may be secured by one or more mounts 1356, fasteners 1360 or both. As can be seen, the mounts 1356 may be configured to create a space to allow the air intake of the external fans 1348 to take in air. In some embodiments, a protective cage 1352 may be provided to protect the external fans 1348 while allowing airflow.

Referring back to FIG. 12C, in one or more embodiments, the environmental control system may also include one or more thermal conductor plates 1224 to absorb heat from hardware components within the component chamber 832. Thus, the hardware components operate at a lower or controlled temperature. In addition, a thermal conductor plate will typically have an increased surface area to allow for dissipation of the heat. Moreover, the thermal conductor plate itself absorbs heat from the hardware components. The thermal conductor plate 1224 may then be cooled to allow it to continuously absorb and transfer heat from the hardware components.

To illustrate, in FIG. 12C, a thermal conductor plate 1224 is at the top of the component chamber 832. As can be seen, a number of components have been mounted to the thermal conductor plate 1224. The heat generated by these components may be transferred to the thermal conductor plate 1224. The thermal conductor plate 1224 may then be cooled by the thermal conductor 916, the airflow system (e.g., fan assembly 924), or both, allowing the thermal conductor plate 1224 to continue to transfer and absorb heat from the hardware components.

Though shown with a single thermal conductor plate 1224, it will be understood that additional plates may be provided. For example, thermal conductor plates 1224 may be at the sides or center of a component chamber 832. In addition, thermal conductor plates 1224 need not be planar in all embodiments and may incorporate one or more bends or openings of various shapes. This is advantageous in that the size of a thermal conductor plate 1224 may be maximized (improving cooling performance) while still allowing the thermal conductor plate to fit within the mobile enclosure 1104.

It is contemplated that the hardware component(s) may be attached to the thermal conductor plate 1224 such that heat may be efficiently transferred to the plate. For example, there may be a direct physical connection between the thermal conductor plate 1224 and one or more hardware components. In addition or alternatively, a heat transfer element (such as described above with regard to FIG. 13D) may be used to facilitate transfer of heat from the hardware components.

The thermal conductor plate 1224 may be formed from one or more materials, such as one or more metals, that readily absorb and transfer heat. The thermal conductor plate 1224 may be of relatively large size (as compared to the hardware components for example), thus allowing the thermal conductor plate 1224 to absorb a relatively large amount of thermal energy. In addition, the size of the thermal conductor plate 1224 increases its surface area which allows the thermal conductor plate to be more easily cooled. It is contemplated that the thermal conductor plate 1224 may have one or more fins or the like to further increase its surface area to improve cooling.

In one or more embodiments, all hardware components within a component chamber 832 (aside from those of the environmental control system) that generate heat may be attached to one or more thermal conductor plates 1224. Given the tight confines of some mobile enclosures 1104, this attachment or connection to the thermal conductor plate(s) 1224 is highly advantageous in maintaining an ideal or desired temperature for the hardware components. Of course, in some embodiments, only some of the hardware components may be attached to a thermal conductor plate 1224.

Referring to FIG. 12C, the mobile enclosure may include a power isolation system 1228 in one or more embodiments. In general, the power isolation system 1228 provides optimized or desired voltage and/or current levels to hardware components of the mobile enclosure. The power isolation system 1228 may insulate hardware components from dirty power, ripple and noise, and other power fluctuations that may cause unreliable system performance. In one or more embodiments, the power isolation system 1228 receives input power from a power source and provides optimal or desired power output for one or more hardware components.

For example, in one embodiment, the power isolation system 1228 may operate on an input voltage range of 8-16VDC and provide one or more output voltages. The output voltages may be set according to optimal operating voltage(s) for the hardware components. In general, an optimal operating voltage will be one that allows a component to operate normally while minimizing power consumption. For example, one or more of the output voltages may be 16 VDC. At 16VDC, current draw is minimized for typical hardware components, thus reducing power consumption which is highly advantageous especially in mobile applications where power may be a limited resource.

The power isolation system 1228 may be configured in a variety of ways. In general, the power isolation system
1228 will comprise an input to accept power and one or more outputs to provide processed power to one or more hardware components. Each output may be independently turned on, turned off, or otherwise regulated. For example, in one embodiment, the power isolation system 1228 may provide voltage isolation from an input voltage for one or more encoders, video processors, computing devices, cellular modems/transceivers, network communication devices (e.g., bridges, switches, routers), audio devices, or other components within a mobile enclosure. As discussed herein, the power isolation system 1228 may accept a wide range of input power. In one embodiment for example, support for a DC input voltage range 8VDC-16VDC may be provided.

[0275] The power isolation system 1228 may comprise various electronic components to process the power and provide optimized power to the hardware components. For instance, it is contemplated that the power isolation system 1228 may comprise a control system, such as described herein, or the like, to perform these functions. The power isolation system 1228 may also or alternatively be controlled by a control system of the mobile enclosure. This allows the power isolation system 1228 to utilize sensor information from one or more sensors connected to the control system, in regulating power.

[0276] For example, in extremely cold environments power may first be provided to heat one or more components or the mobile enclosure generally. Once a desired operating temperature is reached, power may be provided to activate the components. Temperature sensors may monitor multiple areas of and/or components in a mobile enclosure. In this way, the power outputs may be independently controlled based on detailed sensor information.

[0277] In one embodiment, the power isolation system 1228 may be on one or more printed circuit boards that are isolated or remote from other hardware components. It is contemplated that various power sources, such as those described above, may be used to provide the input power. For example, power isolation system 1228 may be powered by one or more batteries, an external power source (such as a vehicle), or the like. Various combinations of power sources may also be used. For example, one or more solar panels and batteries may be used to power the power isolation system 1228.

[0278] The power isolation system 1228 will typically be mounted within the mobile enclosure 1104, though it is contemplated that the power isolation system may be mounted externally or remote from the enclosure in some embodiments. As can be seen from FIG. 12C, the power isolation system 1228 may be mounted away from other hardware components. In this manner, any heat generated by the power isolation system 1228 is isolated from the hardware components. Of course, the power isolation system 1228 may be mounted among the hardware components. It is contemplated that one or more heat transfer elements may be used to transfer heat from the power isolation system 1228 to the heat dissipater 1220, a thermal conductor plate 1224, or other structure, to help cool the power isolation system. However, it is noted that the power isolation system 1228 may be configured to not require cooling assistance in one or more embodiments.

[0279] As stated above, the enclosures herein may be used for various electronic devices. One such device discussed herein is a surveillance device. For example, the enclosures herein may be used for surveillance devices or nodes of different types and configurations. For instance, FIGS. 14A-14B illustrate an exemplary surveillance node in a mobile enclosure 1104 that may be used for audio and/or video surveillance. Though referred to in the following as a node, it will be understood that surveillance or other electronic devices of various types may use the mobile enclosure 1104.

[0280] FIG. 14A is a perspective view showing exemplary components of the surveillance node 100 in an exemplary arrangement within a mobile enclosure 1104. FIG. 14B is a side view providing another point of view of the surveillance node 100. As can be seen, the mobile enclosure 1104 may be relatively compact for easy installation, transport, and use in mobile applications. The mobile enclosure 1104 may have relatively tight internal confines to accomplish such reduction in size. As illustrated for example, there is a small amount of space between the components and the mobile enclosure 1104. Of course, as stated, the enclosures herein may be various sizes.

[0281] As stated, a node may comprise various combinations of processors, memory devices, storage devices, transceivers, and other devices. In the embodiment shown, the surveillance node 100 comprises a video processor 1404, a hardware codec 1408, and a cellular transceiver 1412. The video processor 1404 may generally be configured as a network video recorder in one or more embodiments, though the video processor 1404 may have capabilities in addition to video recording. For example, the video processor 1404 may be used to receive video and/or audio input and convert the input to a format usable by the hardware codec 1408.

[0282] The video processor 1404 may be configured in various ways. In one embodiment, the video processor 1404 may include or utilize one or more memory devices and/or storage devices in performing its function. For example, videos may be stored on a memory or storage device by the video processor 1404.

[0283] In one embodiment, the video processor 1404 may execute one or more applications or algorithms, such as to perform video analysis or event detection. In some embodiments, the video processor 1404 may be a computing device and may run an operating system, such as Windows (trade mark of Microsoft Corporation) for example to support such applications. A computing device is beneficial in that it allows a variety of peripherals to be used by the video processor. For example, the video processor 1404 may have a GPS receiver connected thereto used to detect the current location of the mobile enclosure. The location information may be associated with captured video or used as a factor in video analysis/event detection.

[0284] In general, the hardware codec 1408 will be used to compress video such that it may be transmitted over communication links of various bandwidths. In the case of a cellular link, the video may be compressed to reduce bandwidth requirements. It is contemplated that the video processor 1404 may also or alternatively be used to compress video. In these embodiments, a separate hardware codec 1408 may not be provided. In addition, the video processor 1404 may perform analysis on an audio/video stream such as to detect one or more events or triggers, such as described above.

[0285] To communicate with other devices, the video processor 1404, hardware codec 1408, or both may be coupled with the cellular transceiver 1412. This allows communication over one or more cellular communication links. Of course, various transceivers may be used to communicate over a variety of communication links, as discussed above.
The cellular transceiver 1412 (or other transceiver) may also be configured as a network switch in some embodiments. This is beneficial because the transceiver may then be connected to one or more other devices internal and external to the mobile enclosure 1104. For example, internally, the video processor 1404, hardware codec 1408, one or more controllers, or other hardware components, may be given access to one another and access to external devices through a switch connection provided by the transceiver. Externally, the switch functionality allows other sensor or devices to connect to the mobile enclosure 1104. This allows communication links as well as data and resources to be shared between the nodes/devices.

[0287]

It will be understood that the switch, router, or both of a transceiver may be provided by separate components. For example, the mobile enclosure 1104 may include a distinct router and switch or a combination switch/router apart from its transceiver. In addition, it is noted that other components may also be installed within the mobile enclosure 1104. For example, location detection components, such as GPS receivers, triangulating receivers, and the like may be supported by the mobile enclosure 1104.

[0288]

In operation, these hardware components will typically generate heat. The mobile enclosure 1104 is designed to control the environment to allow reliable operation of the components. To illustrate, in the embodiment shown, the hardware components have been mounted to a thermal conductor plate 1224. In this manner, heat from the hardware components may be absorbed or transferred to a thermal conductor plate 1224 which relieves some of the heat from the components. The thermal conductor plate 1224 as well as the hardware components themselves may also be cooled by the operation of a thermal conductor 916 and airflow system comprising a fan assembly 924, as described above. The heat from the thermal conductor 916 is transferred to a heat dissipater 1220 where it is dissipated or released into the environment. Simultaneously, the hardware components are protected from the external environment by a component chamber 832 of the mobile enclosure 1104 which may have one or more layers of insulating or protecting materials. Moreover, the hardware components are protected from vibration and other movements by one or more vibration dampening assemblies 1216 within and/or external to the mobile enclosure 1104.

[0289]

In some cases, the video processor 1404, hardware encoder 1408, or other component may require additional cooling. For instance, these components may generate additional heat when recording/compressing video. In addition, some video processors 1404 or hardware encoders 1408 may generate substantial heat during operation as a function of their design. In these situations, it is contemplated that the environmental control system may provide additional cooling to these components, such as by utilizing one or more additional thermal conductors 916.

[0290]

FIG. 14C illustrates one such embodiment having multiple thermal conductors 916, 1420. As illustrated, the first thermal conductor 916 is located beneath a cold transfer element 1340 and the second thermal conductor 1420 is beneath a video processor 1404. Though the second thermal conductor 1420 may be physically similar or identical to other thermal conductors described herein, the second thermal conductor will be referred to herein as a direct conduction thermal conductor 1420 because it will typically be configured to cool particular hardware components. Because the first thermal conductor 916 may be configured to cool the air (or other gas) in the mobile enclosure, it may be referred to as a convection thermal conductor.

[0291]

For instance, in FIG. 14C, the direct conduction thermal conductor 1420 has been mounted in contact with a component, namely the video processor 1404. In this manner, the direct conduction thermal conductor 1420 may directly cool the component, such as by transferring heat away from the component or actively cooling the component. The direct conduction thermal conductor 1420 may also be in contact with the heat dissipater 1220 allowing heat from the component to be dissipated to the environment, such as described above. Though shown associated with a particular component, namely the video processor 1404, it will be understood that direct conduction thermal conductors 1420 may be used with other components, and that additional direct conduction thermal conductors may be used.

[0292]

It is contemplated that the direct conduction thermal conductor 1420 may be positioned near or at the heat source (s) of a component if desired. For example, in FIG. 14C, the direct conduction thermal conductor 1420 has been centrally located relative to the video processor 1404 to better cool the video processor. In addition, in some embodiments, multiple direct conduction thermal conductors 1420 may be used to cool a single component. It is noted that one or more heat transfer elements may be used to form a connection between the component and the direct conduction thermal conductor 1420 in some embodiments.

[0293]

In this way, the direct conduction thermal conductor 1420 may remove thermal energy directly from a component within the mobile node. Thermal energy may be transferred to the thermal dissipater, thus cooling the component. Moreover, as stated, a small amount of airflow over the external heat sync generated by various means may be used to break the thermal barrier, to release thermal energy.

[0294]

As shown in FIG. 14C, the direct conduction thermal conductor 1420 has been mounted such that its top surface is flush with that of the heat dissipater 1220. This is advantageous in that it allows a component to contact the heat dissipater 1220 as well as the direct conduction thermal conductor 1420. In this way, heat may be transferred to both the heat dissipater 1220 and the direct conduction thermal conductor 1420. For example, in FIG. 14C, it can be seen that the video processor 1404 has a large contact area with both the heat dissipater 1220 and the direct conduction thermal conductor 1420.

[0295]

In embodiments where the direct conduction thermal conductor 1420 requires electrical or other connections, it is contemplated that one or more channels 1416 may be made in the heat dissipater 1220 (or other mounting structure). This allows the direct conduction thermal conductor 1420 to be flush mounted and connected via one or more connections. For example, the direct conduction thermal conductor 1420 may comprise a Peltier device and the one or more channels 1416 may be used to provide an electrical connection to the Peltier device. In addition or alternatively, the direct conduction thermal conductor 1420 may be controlled by a control system such as the control system described herein.
In these embodiments, the connection between the direct conduction thermal conductor 1420 and a control system may occur through the one or more channels 1416. Moreover, the one or more channels 1416 may serve as a conduit for connections to one or more sensors of the control system, such as to receive information that may be used to control the direct conduction thermal conductor 1420. For example, sensor information may be received through cables running through the one or more channels 1416. The control system may utilize this information to turn off, increase, or decrease power cooling provided by a direct conduction thermal conductor 1420. For example, sensors may detect the temperature of the video processor 1404, hardware codec 1408, cellular transceiver 1412, heat dissipater 1220, other components, or a combination thereof to allow control of their associated direct conduction thermal conductors 1420 (and/or other thermal conductors).

The direct conduction thermal conductor 1420 need not be flush mounted in all cases. For example, the direct conduction thermal conductor 1420 may extend from a surface, such as the surface of a heat dissipater 1220. As another example, the direct conduction thermal conductor 1420 may be inset within a surface, such as the surface of a heat dissipater 1220. Typically, the direct conduction thermal conductor 1420 may be mounted such that its receiving end can contact a component to cool the component. Of course, as stated, one or more heat transfer elements may also be used to create this contact.

It is noted that in some environments, such as exceedingly cold environments, it may be necessary to delay applying power to a component because immediate application of power may damage the component. It is contemplated that the direct conduction thermal conductor 1420 may be configured to preheat the component to a suitable operating temperature before the component is provided power. For example, a direct conduction thermal conductor 1420 (or other thermal conductor) comprising a Peltier device may be used to heat a component such as by reversing the polarity of the electricity provided to the Peltier device. Once a suitable operating temperature is achieved, power may then be applied to the devices within the mobile node. Of course, various heating elements may be used to warm or heat a component, such as described above. In addition, the control system may determine when to apply heat and when to apply power, as also discussed above.

Thus, as can be seen, a convection thermal conductor may be used to control or normalize the temperature generally within the mobile enclosure. A direct conduction thermal conductor may be used to control or normalize the temperature of one or more components within the mobile enclosure. The combination of convection and conduction thermal conductors allows a surveillance or other device within the mobile enclosure to operate in a wide range of environmental conditions, including those having large temperature variations.

Reliability and availability are key factors in surveillance especially when surveillance is adopted for mission critical aspects of ensuring public safety. The enclosures described herein provide a controlled environment for a node's components to achieve high reliability, uptime, and availability. This also reduces monetary and other costs associated with downtime, repair, or both. In fact, it is specifically contemplated that one or more embodiments of the enclosure may include design features or configurations that comply with NEBS (Network Equipment Building Standards) Level 3 standards for reliability. For example, an airflow system having backup fans or the like, as described above, may be included to comply with NEBS Level 3. Such compliance ensures an extremely high level of equipment sturdiness and disaster-tolerance.

While various embodiments of the invention have been described, it will be apparent to those of ordinary skill in the art that many more embodiments and implementations are possible that are within the scope of this invention. In addition, the various features, elements, and embodiments described herein may be claimed or combined in any combination or arrangement.

What is claimed is:

1. A mobile enclosure comprising:
   a sealed component chamber configured to enclose one or more components;
   one or more vibration dampening assemblies configured to reduce vibration of at least one of the one or more components;
   a thermal conductor having a first portion within the sealed component chamber and a second portion outside the sealed component chamber, the first portion configured to cool the one or more components in the sealed component chamber; and
   a thermal dissipater mounted to an exterior portion of the sealed component chamber, the thermal dissipater connected to the second portion of the thermal conductor, wherein the thermal dissipater transfers heat away from the thermal conductor.

2. The enclosure of claim 1, wherein the sealed component chamber is formed from a multilayer material.

3. The enclosure of claim 1, wherein the thermal conductor is a Peltier device.

4. The enclosure of claim 3 further comprising a controller configured to increase power to the thermal conductor to increase cooling at the first portion of the thermal conductor and configured to decrease power to the thermal conductor to decrease cooling at the first portion of the thermal conductor.

5. The enclosure of claim 1, wherein the one or more components are mounted to at least one of the one or more vibration dampening assemblies.

6. The enclosure of claim 1 further comprising one or more direct conduction thermal conductors in contact with at least one of the one or more components and with the thermal dissipater, wherein the thermal dissipater transfers heat away from the one or more direct conduction thermal conductors.

7. The enclosure of claim 1 further comprising an airflow system adjacent the first portion of the thermal conductor, the airflow system configured to generate at least one airflow within the sealed component chamber.

8. The enclosure of claim 1, wherein the second portion of the thermal conductor is embedded into the thermal dissipater.

9. A mobile enclosure comprising:
   a thermal conductor having a cooled portion and a heated portion;
   a sealed component chamber configured to enclose one or more components, the cooled portion of the thermal conductor positioned within the sealed component chamber;
   an airflow system adjacent the thermal conductor, the airflow system configured to circulate air within the sealed component chamber;
a vibration dampening assembly configured to isolate the sealed component chamber from vibration; 
a thermal dissipater external to the sealed component chamber, the thermal dissipater coupled with the thermal conductor to receive and dissipate heat from the heated portion of the thermal conductor; and 
a power system having one or more outputs to provide processed power to the one or more components.

10. The mobile enclosure of claim 9 further comprising one or more thermal isolation materials between the component chamber and the thermal dissipater.

11. The mobile enclosure of claim 9 further comprising a direct conduction thermal conductor in contact with at least one of the one or more components to directly cool the at least one of the one or more components.

12. The mobile enclosure of claim 9, wherein the component chamber comprises an opening to accept the heated portion of the thermal conductor.

13. The mobile enclosure of claim 9 further comprising one or more external fans mounted to the thermal dissipater, the one or more external fans configured to break a thermal barrier around the thermal dissipater.

14. A method for protecting one or more components within a mobile enclosure comprising: 
   protecting the one or more components within a sealed component chamber of the mobile enclosure; 
   cooling the sealed component chamber with a cooled end of a thermal conductor; 
   generating at least one airflow within the component chamber and across at least a portion of the cooled end of the thermal conductor 
   cooling a heated end of the thermal conductor with a thermal dissipater coupled to the heated end, the thermal dissipater external to the sealed component chamber; and 
   isolating at least a portion of the component chamber from heat dissipated by the thermal dissipater with one or more thermal isolation materials.

15. The method of claim 14 further comprising: 
   measuring at least one temperature within the component chamber; 
   increasing power to the thermal conductor to generate additional cooling at the cooled end of the thermal conductor if the at least one temperature is above a first temperature threshold; and 
   decreasing power to the thermal conductor to reduce cooling at the cooled end of the thermal conductor if the at least one temperature is below a second temperature threshold.

16. The method of claim 14 further comprising generating an external airflow at the thermal dissipater to break a thermal barrier around the thermal dissipater.

17. The method of claim 14 further comprising directly cooling at least one of the one or more components with a direct conduction thermal conductor, the direct conduction thermal conductor in contact with the at least one of the one or more components.

18. The method of claim 17 further comprising: 
   measuring at least one temperature of at least one of the one or more components; 
   increasing power to the direct conduction thermal conductor to generate additional cooling at a cooled end of the direct conduction thermal conductor if the at least one temperature is above a first temperature threshold; and 
   decreasing power to the direct conduction thermal conductor to reduce cooling at the cooled end of the direct conduction thermal conductor if the at least one temperature is below a second temperature threshold.

19. The method of claim 14 further comprising isolating the component chamber from vibrations from the thermal dissipater with one or more vibration dampeners.

20. The method of claim 14, wherein the component chamber comprises a multilayer material including layers selected from the group consisting of at least one rigid layer and at least one insulating layer.

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