White Paper on

The Bandwidth Management System:

A Technical Specification

Introduction

The purpose of this white paper is to define the role of, and develop the specifications for, the Bandwidth Management System (BMS).

The BMS is an integration tool to bring together the different streams of communications based services available to a 1st world economy consumer.

The paper is structured into three parts;

1. The definition of the BMS and its role, and;
2. The explanation of the BMS using the OSI (Open Systems Interconnection) model as a framework.
3. The limitations on the platform implementation to provide a successful service.

Finally, an example of enhanced consumer services using the BMS is included to demonstrate the flexibility of the technical concept.

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System Purpose

Task

The Bandwidth Management System (BMS) is designed to overcome the difficulty and cost in connecting the wide range of communications technologies available for a home and small business in a modern economy.

The BMS supports the following functions:

1. On-the-fly conversion between different network topologies, to provide consumer access to services regardless of the technologies used to generate and deliver the services.
2. An integration system between different services and between compatible existing consumer products.
3. To provide 'store and forward' capacity for the services, to enable consumers to access services at the most convenient period without incurring peak-period charging for these services.
4. To collate historical data, to allow the consumer to recall and analyse past service details.
5. A control system, to enable more efficient management of home and small office resources.
6. A platform for delivering future services taking advantage of data communications, as they are developed.

Market Positioning

The target market for the BMS is the consumer in a 1st world society, enjoying the full benefits of modern utility services including electricity, telephone and television.

The full realisation of network nodal effects can only be realised if the BMS achieves total market penetration, The BMS, like other network nodal systems, provides an increasing economic return per consumer as the total number of connected consumers increases. In addition, there is a constantly improving economy of scale. Hence, the full value of the BMS will be achieved through full market penetration.

The 1st world consumer has developed a series of expectations, based upon the performance of consumer electronic products including televisions, video recorders and stereo equipment. The BMS is required to meet or exceed these requirements:

1. High reliability, with no maintenance required by the consumer.
2. An expected lifespan of 7 years, which also minimises the requirement for replacement units.
3. Compatibility with future models.
4. Simple controls, allowing people with marginal linguistic skills and educational background to operate the unit.

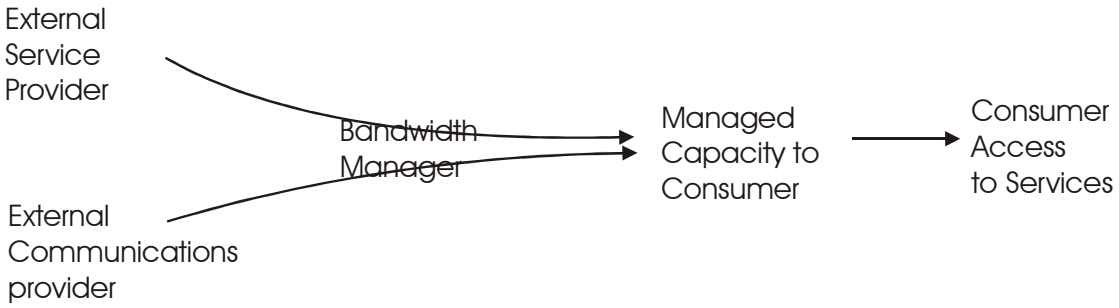
The BMS is also required to meet future consumer requirements and expectations. In particular, the BMS is required to be:

1. Designed for eventual recycling, to abide with European environmental regulations and expected market conditions by the end of the product's lifespan.
2. To operate with minimal power consumption and heat output.
3. To not use any materials from endangered species or inorganic compounds in short supply.
4. To be manufactured using processes that minimise energy usage and do not emit any environmentally damaging compounds.
5. To be installed simply and quickly, along with self-diagnosis capability and the capacity to automatically notify support services of present or impending problems.

Positioning in the Client Value Chain

The BMS is designed to create positive economic value for the consumer. The objective is to generate no less than a ten percent efficiency gain for the consumer, thereby ensuring a compelling business case for the technology implementation. This positioning creates the necessary incentive for the consumer to install the BMS into their home and/or small office.

A high-level diagram showing the value chain is included below. More specific value chains depend upon the individual services being supported by the BMS.



Geographic Distribution

The end consumer is - all representatives of the 1st world economy. The BMS is required to support communications in both densely populated centres, such as an apartment building, as well sparsely populated regions such as a farming sector.

The technologies implemented within the BMS must be able to support tens of thousands of devices within a single steel frame building to cope with dense apartment living in major cities. The technologies need to be able to differentiate between consumers and meet bandwidth expectations allowing for inter-device interference. Densely populated areas are best served by a combination of terrestrial cable technologies, as the costs can be spread amongst large numbers of users, and low-power radio (RF) cells for short-range communications.

Conversely, rural sectors often have several kilometres between consumers, stretching in some cases to vast distances. The low consumer density results in costly terrestrial services, while low-power RF services do not provide sufficient reach between network nodes. In these cases, higher power RF can provide reach at the expense of limiting the total number of devices that can be active in the sector.

The conflicting requirements based on population density and affected by physical topology dictate a flexible network capability, with active reconfiguration to meet different requirements. Automated device reconfiguration allows the maximisation of the available bandwidth capacities, while taking into account changing conditions including interference from local weather, transient consumers and shifting service demand patterns.

BMS Technical Requirements

OSI Reference Model

The Open Systems Interconnection (OSI) model provides a framework for structuring the different aspects of the BMS concept. The strengths of the model are that:

1. All communications can be structured into the model.
2. Voice and broadcast media are construed as data communications streams and applications.
3. Currently uncaptured information can be collated and accessed, including local voice and parametric data
4. The OSI model provides a framework where appropriate standards, whether open or proprietary, are applied to support specific model layers.
5. The framework also provides the basis for specification for the BMS hardware and network system software requirements.

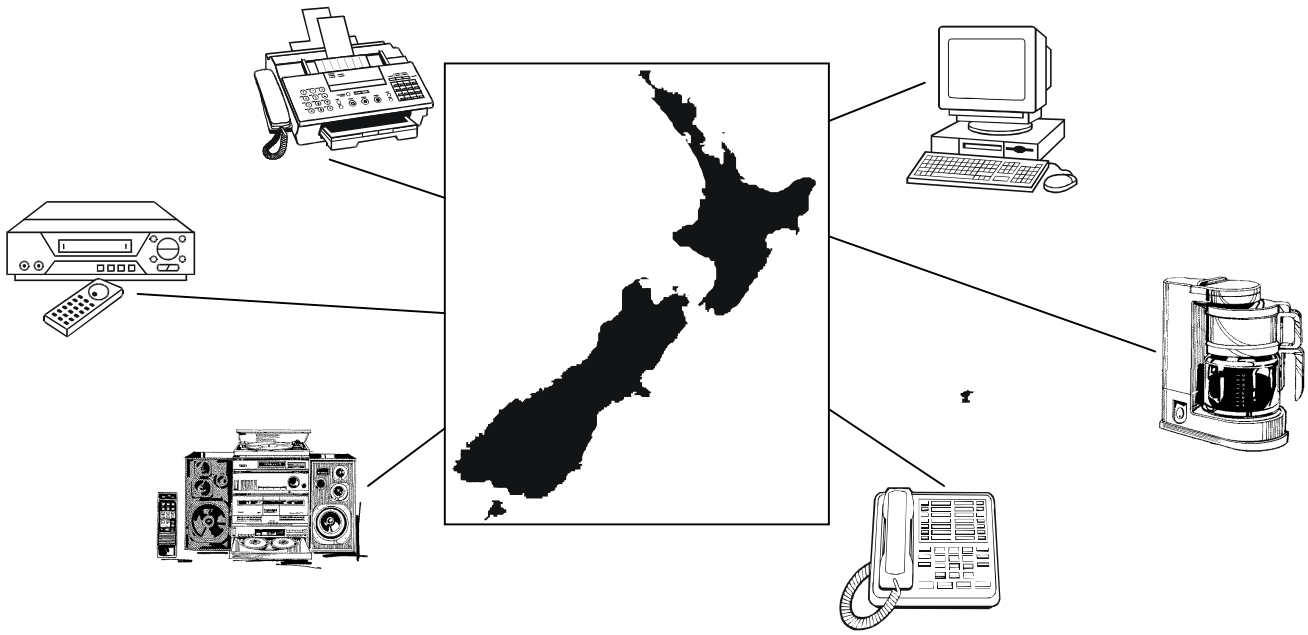
Network Enabled

In order to operate a Network Operating System, the BMS is required to be a network device. The components of the BMS are network devices in the same manner as external systems. The Network Operating System does not logically distinguish between local and remote systems, but instead by access bandwidth.

This requirement enables automated network management, distributed service provisioning and co-operative processing between BMS platforms.

This feature is different from traditional computing platforms in that the BMS is as aware of the other devices on the network as its own components. Traditional systems are inherently aware of only their own local components and communicate with remote devices only through gateways.

The BMS can use off-site resources to aid in the completion of tasks and accessing of data. This activity is governed by the proprietary safeguards implemented into the technology.



OSI Implementation

Overview

The OSI model consists of seven layers. Each layer defines part of the functionality required to successfully provide a network information service. The seven layers have been extended to allow for the BMS network node technology and are defined as follows:

- Application (Layer 7) services are intuitively obvious 'end-user' application services. They may be tools for other applications and messaging systems, or application in their own right with which the 'end-user' interacts.

- Presentation (Layer 6) formats received data for applications and converts data into generic formats for transmission. The conversion of data includes any compression of data.

- Session (Layer 5) provides permission for two devices to communicate and exchange data. The Session layer monitors session identification to ensure only designated parties have access to session information. The Dialog Control service establishes whether the session supports one-way (broadcast) or two-way communications, while the Synchronisation service ensures receipt of data.

- Transport (Layer 4) manages the transfer of data one location to another, whether local or remote.

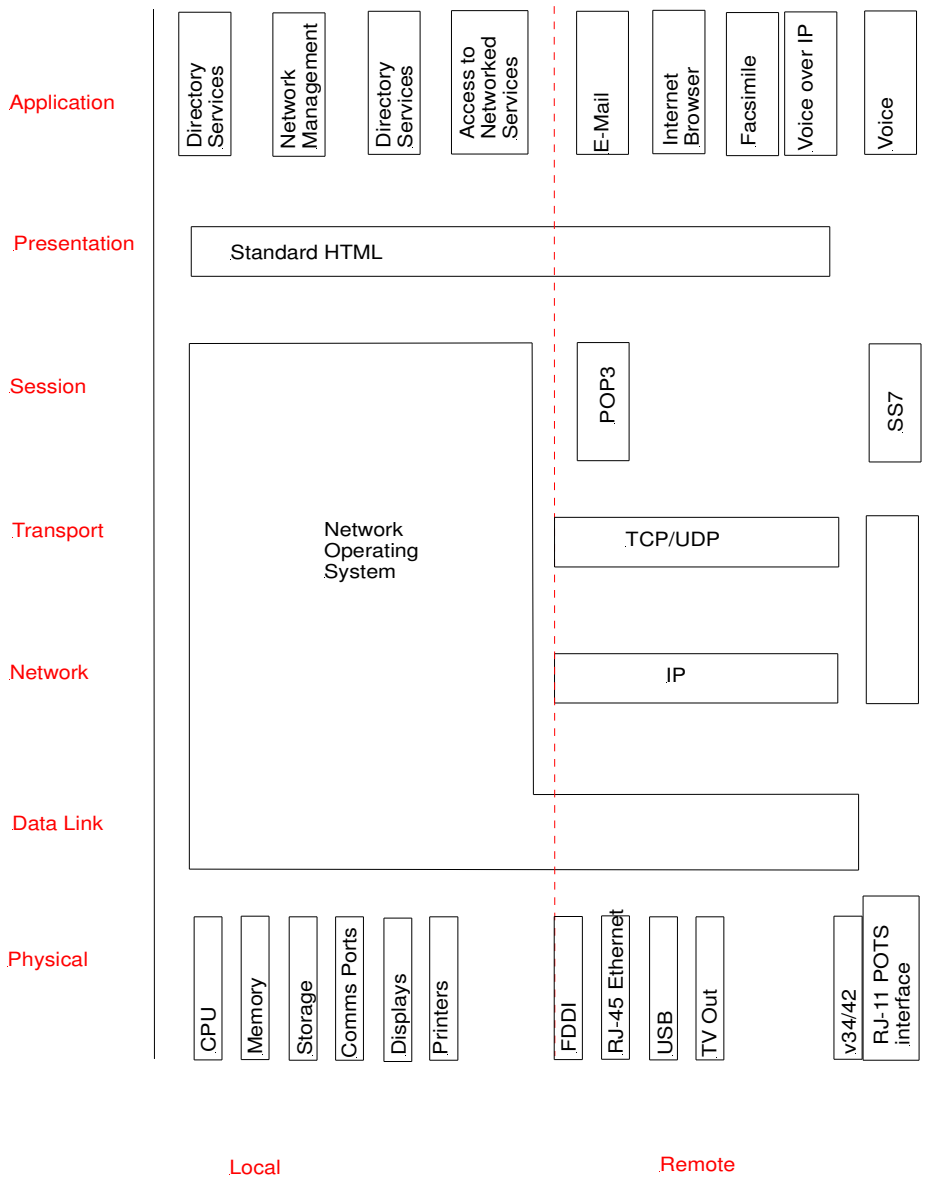
- Network (Layer 3) provides addresses, a routing architecture to enable systems to know where to send data and gateways from one system to external devices.

- Data Link (Layer 2) handles the conversion of data from a binary form into data frames. These data frames vary according to the network devices being addressed. The OSI standards recognise two components to Layer 2: the MAC (Medium Access Control) that controls access methods and provides permissions for transmission, and the physical source and destination addresses; and LLC (Logical Link Control) which manages frame synchronisation, flow control and error checking within the frame.

- Physical (Layer1) provides the mechanical and electrical connections to enable transfer of data from one device or component of a device to another.

Implementation

The OSI Implementation diagram illustrates the major systems included in the implementation stack. The diagram illustrates local communications on the left side and remote communications on the right. This diagram is illustrative only and not all-inclusive.



The Access to Network Services listed above include all value-added applications that take specific advantage of the network operating systems architecture. The consumer-orientated applications include:

- The Security Management application, which tracks movement throughout premises and raises an alert when unauthorised people gain access.
- Power Management system, which switches off lights when rooms are not in use and can manage water and room heating.
- Intra-premises communications, using microphones and speakers connected in each room.
- Personal accounting, including access to EFT-POS based payment systems for transferring money between accounts and data collection of purchases through a secure service.

Bandwidth Management

The BMS provides the delivery mechanism for managing wholesale bandwidth.

The information consumer is interested in accessing services at varying price points and service quality levels. The current data communications market is immature and has advanced little towards the end-point of fully niched bandwidth market products.

Access

The BMS reacts to a customer request for service by evaluating the available wholesale bandwidth. The BMS selects the service based upon congestion levels, pricing and pattern of service requirements. The technology is capable of taking communications from practically every source, including:

- Fibre Optic cables supporting the FDDI specification
- Ethernet
- USB jacks, including connections to popular gaming console products
- TV broadcast signals, including PAL and NTSC over the VHF and UHF bands
- FM Radio signals over the VHF bands.
- RF signals from other network devices
- Voice from the Public Switched Telephone Service (PSTN), also called POTS (Plain Old Telephone Service).
- Facsimile and modem traffic over the PSTN.
- AC Lines, for communications and power.

In addition, the BMS can also support the following communications with minimal enhancement, as required to support existing infrastructure in specific regions..

- Non-standard fibre cables
- Cellular telephone networks
- AM HF radio
- Satellite reception

Billing

Billing can be provided by each BMS keeping a log of services accessed and the current rate. The BMS can upload the logs to a billing device for processing as required. Alternatively, the BMS can be used to bill and collect payments directly via the EFT-POS service.

The BMS can be instructed to restrict service if the consumer does not pay the account, encouraging prompt payment. Minimal services can be left enabled to provide the consumer access to bill payment and normally free services.

Network Management

Network Management is automated by the BMS, eliminating a major component of network management costs. Alerts are generated in case of hardware failure, which can triggering hardware support or merely advise the consumer of the device failure.

Software Maintenance

The BMS software is maintained centrally. Software updates are released to the network as completed, allowing the BMS to automatically access and update their core code. The software update process is invisible to the consumer and is a free service.

User Interface

The BMS user interface is dictated by the KISS principle, (i.e. Keep It Simple, !.)

The end-user can access the BMS functions through different options:

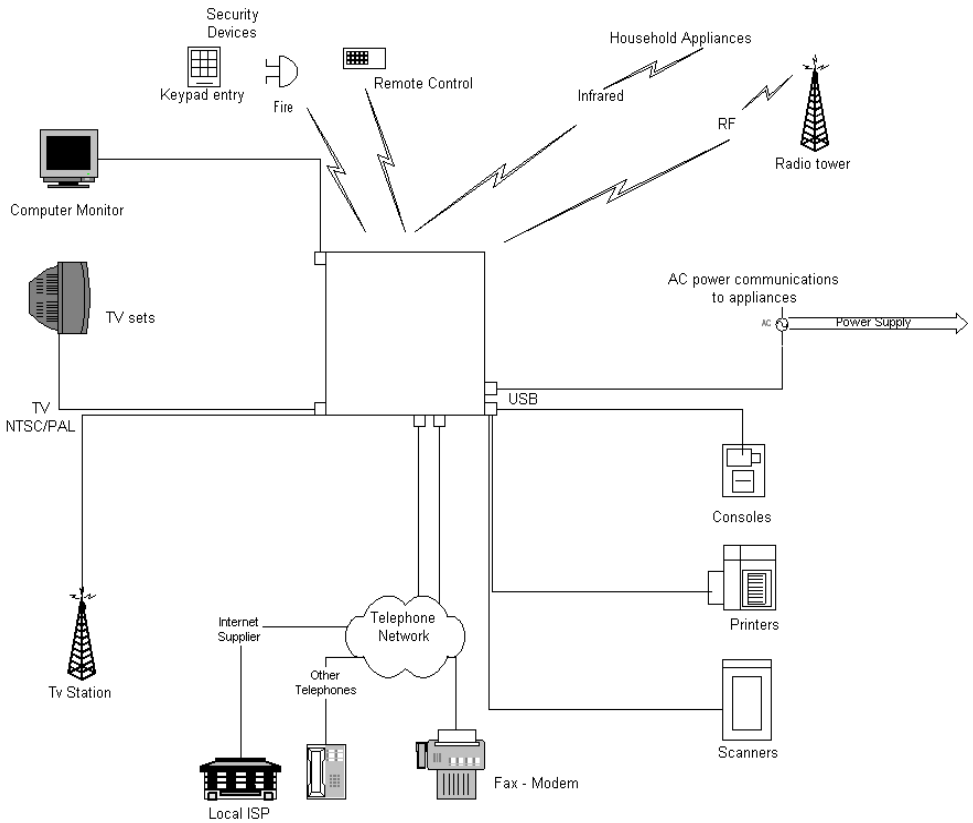
- LCD Display — The BMS can support a LCD display on the unit. This provides a limited size screen to display information.
- TV — The BMS can support standard televisions using NTSC or PAL formats. This screen type allows the unit to be used in most existing households without extra equipment.
- Voice — The system can be instructed by voice and can present verbal data.

The standard interface is a simple 2 layer menu, based on the principle that nothing is further away than 3 key presses on the remote control, or 3 voice commands.

Computer-savvy consumers can further enhance their systems with standard PC componentry, available from a wide range of sources.

- Console — Popular gaming consoles can be connected, providing two-way communication and enhanced services.
- Monitor — Standard computer monitors can be added by the end-user to provided higher quality displays than television.
- Printer — Standard PC printers can be used to print information selected from a screen. A range of printers is currently supported.
- Scanners — TWAIN compatible scanners can be connected via the USB port for data input.
- Keyboard — A full-sized keyboard can be connected to the USB port.
- Mouse — A mouse can be connected to the USB port.
- Camera — A camera can be used to enable video phone services

More sophisticated user interfaces can be enabled by sophisticated users with supporting hardware.



Platform Implementation

Mandatory Requirements

The BMS platform is required to meet the above Technical Requirements. There is no requirement for the BMS to be compatible with any existing hardware design. The design is only required to be able to share data with other systems using data and voice communications standards.

The BMS platform design is required to meet the following objectives:

1. Hardware design and selection driven by ability to support OSI reference model, availability of components for manufacture and ability to support the product in operation.
2. Ports to support communications functions, including USB, RJ-45 Ethernet, RJ-11 phone, modem, infrared, TV-out, SVGA and AC power.
3. Economic cost to the end consumer needs to be within the market expectations for a consumer appliance, to prevent marketshare resistance on the basis of entry-level costs and to ensure a positive economic return to the consumer.
4. Remote Control to allow end-users to access services from throughout their home or office. The remote control should be no larger than a cellphone.
5. Remote Security nodes to enable BMS monitoring of the consumers' rooms. The nodes are to be connected to the electrical system with battery backup to withstand sabotage by intruders.
6. Sufficient processing power, memory and storage to ensure short response times to end-users.
7. Sufficient storage to enable store and forward services, including recording of telephone conversations.
8. Flexibility to enable different display options, keyboards and other input/output devices to be connected.
9. Small size and rugged construction.
10. The design is required to be suitable for mass production using a large number of manufacturers, to ensure adequate supply to consumers.
11. An internal battery to keep system alive during short power outages.
12. A Power light is required to tell the consumer when the unit is active.
13. A second light, or a different colour on the power light, is required to shine when the remote control is in use. This feedback conforms that the remote control is working.

Preferences

It is preferable for the design to use low power componentry to maximise the life of any standby battery and reduce operating costs.

Different styling options are preferable to improve the products appeal to different market niches.

Alternative Software

The Network Operating System has been implemented through a long-term research and development programme. It is possible to substitute the Network Operating System core with a suitable host operating system. However, reliability is the overwhelming requirement of any host operating system. A host Operating System would be required to operate continuously 24 hours per day, 7 days per week, 52 weeks per year without failure.

Example of Enhanced Consumer Service

The BMS is a network node inter-connecting a myriad of services and technologies. The BMS can be further enhanced through adding intelligent peripheral devices, which effectively add senses and limbs to enable the BMS to interact with its environment.

One example is the intelligent Bayonet fitting.

Intelligent Bayonet Fitting

Description

The Bayonet fitting is an international standard housing and connection for a light bulb to fit into a socket. The technology is well established and has changed little during the 20th century.

The Intelligent Bayonet fitting replaces the old fitting with a functionally and cosmetically similar device, with a number of enhancements:

1. A Microphone, to allow the end-user to interact with the BMS and to support communications services.
2. A Speaker to support voice messaging, either from the system in reaction to commands or as part of a communications service.
3. A rudimentary camera sensor, to detect motion and changes in the environment in the visible and infra-red spectrums. The camera is not sufficiently distinct to capture images of people, thereby protecting privacy and giving assurance to the consumer.
4. A Battery, to provide power in the case of a mains power failure or an attempt at sabotage by an intruder.

Potential Services

The Intelligent Bayonet feeds the BMS with data , which allows a range of new services to be provided to the consumer. These potential services include:

1. Security Management. The BMS is aware of the number of authorised people within the building at any one time. If an additional person enters the premises, the BMS can alert the inhabitants and if necessary pass the alert to emergency response services.
2. Mobile Communications. The Intelligent Bayonet enables the end-user to use communications services with other parts of the premises or an individual or group outside the premises, while moving about the building. The BMS switches between Intelligent Bayonets as the person moves about, to maintain optimal voice services.
3. Light Control. The BMS can turn on lights as people enter a room and turn the lights off after they exit, conserving electricity. In addition, lights can be dimmed or brightened to provide different mood settings and to support different activities.
4. Simulated Occupancy. The light controls can be set to operate as if a person occupied the building when nobody is uninhabited for a period of time. This simulation reduces the chances of burglary.
5. Humidity Monitoring. The BMS sensors can detect humidity levels, which is the basis for efficient climate control, as humidity rather than temperature is the basis for comfortable climates for human habitats.

6. Health Monitoring. The BMS builds up a database of normal activity. If an individual acts oddly, or stops or falls in an unusual place, or makes strange noises, the BMS can ask the person whether he or she is feeling all right. If there is no response, the BMS can alert medical services to aid the person.
7. Language Service. The BMS can act as a dictionary for different languages, which the user can reference upon command. In addition, the BMS can assist translation between the end-user and another person who do not share the same language, either through a communications service or when the person is present in the building.
8. The system can detect some abnormal light and sound combinations, and communicate with the consumers the information., either through local speakers or via a communications service.

Further Potential

As has been demonstrated, adding an intelligent peripheral provides more than a simple extension of the BMS capability, but opens up a myriad of other potential benefits. Each new peripheral added is equivalent to adding a new dimension to the BMS capability, with exponential improvement in the benefits to the consumer.

In addition, additional peripherals can enhance other services. For example, an intelligent medical bracelet monitoring vital signs would enhance a health monitoring service. A communications badge could improve audio for mobile communications. An enhanced video camera station could enable full video communications services.

These enhancements all provide new opportunity to provide economic value to the information consumer.

Example of Front of BMS

Example of Rear of BMS