Wireless Project Design Considerations
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1 Introduction

The world of wireless platform integration has evolved greatly in the past few years. There are a number of hardware and software solutions readily available that address the growing need and desire for market driven solutions. A wide range of hardware options exist and provide many flexible solutions. A cottage industry of software developers have evolved and provide support for many different hardware solutions. The wireless industry has encountered tremendous growth thus allowing for rapid vertical market deployment of solutions that were formerly provided via proprietary networks and hardware/software solutions. Networks have standardized to provide easy access at an affordable cost for many solutions that were cost prohibitive even just a few years ago.

The process of researching, implementing, and maintaining solutions is a challenge. Many installations ultimately provide a quick return on the investment but there are unforeseen events that can extend that return. The following information will provide an overview of the various components required for a successful wireless deployment. Some of the most common pitfalls of installations will be discussed and the associated solutions reviewed.

2 The Market Solutions

The rapid convergence of multiple technologies has driven many market solutions for vehicle/item location and communication solutions. Historically, these deployments have been developed as a proprietary solution using custom designed equipment and solutions. Typically, the networks have been private in nature and managed/operated by the entity that funded the effort.

In recent years, many public network operators worldwide have replaced the private networks for many solutions. This has transpired due to a number of factors:

- Increased coverage of public wide area network deployments
- Ability to reduce in-house operations used to support private network infrastructure
- Increased reliability of wireless network deployments
- Greater cost value for service provided
- Open network compatibility
- Good selection of cost-effective hardware and software solutions compatible with the network technology

Natural solutions have emerged to accommodate markets that required a resolution to an existing problem. Many require real-time reporting and the ability to monitor field deployed devices and /or vehicles in a wide geographic area. Public network providers realized an opportunity once the network technology was good enough to support wireless data applications. As the networks mature and provide greater speeds, more application solutions will begin to emerge in support of solutions that require greater bandwidth.

The public safety market is a prime example. Funding was presented in the late 90’s in order to spark the use of technology within the market. This is when many entities began to replace existing private radio networks with public carrier WAN solutions. Carriers soon realized the potential and adjusted offerings and price plans accordingly. A large number of solution providers began to emerge with application-specific solutions that are now a common offering for public safety entities.

Projects should consider the big picture cost as compared to the existing deployment. Typically, portions of the project can be phased such that the financial and support impact can be reduced. For example, server software, middleware, and/or applications can support a number of different wireless network technologies and should be considered first as the majority of carriers offer an IP backbone for their wireless offerings. Subsequently, as decisions are made, the other hardware and software components can be added to the solution as they tend to be more application driven based on the solution.
3 The Hardware

Hardware solutions consist of devices that are used to facilitate remote platform communication. The relative cost has of hardware has been reduced due to market competition. As technology in general has advanced in the areas of processors, memory, and associated cost reduction, the hardware solutions have increased in number. The standardization of wireless technologies has greatly increased the popularity of wireless solutions across a number of vertical applications. The use of standards like GSM, CDMA, 802.11, Bluetooth, and NMEA-183 has greatly reduced the complexity of many installations. The only drawback is that the various hardware solutions are not consistent across vendors. This poses an impact for integrators as they use various devices for a solution. The software and accessory hardware has to be tailored to each individual solution. This adds cost and time to each deployment. An example would be the type input/output (I/O) that is provided in a given hardware device. Some vendors provide only low voltage signaling. This can limit the ability of the device to drive switches and relay devices in certain installations.

Even though most hardware has standardized on a given network technology, the devices can vary greatly. Most hardware devices use standard commands that can be used for programming functional features. In addition, most vendors implement custom commands that are unique to the feature set provided for the device. Support tools are sometimes provided for configuration but most often they are not provided by a vendor. This forces a third-party to support multiple hardware architectures in their software or it requires the customer to outsource the development of an application that can provide the capability.

Projects should outline the present and future requirements of the solution and select components accordingly. The integration of an embedded TCP/UDP/IP stack, JVM, event processing engine, internal code space processor, etc. should be considered as a component of additional cost required to implement a solution. The integration effort should also be considered if there are any external processors and/or components required to develop the solution. The inclusion of various architectures into a vendor’s device can potentially provide a large amount of savings depending on the requirements. The trend in the industry is that the major wireless module vendors are building these capabilities into hardware at the module level thus providing a very robust product to more vertical hardware developers that require a wireless WAN component. A recent development that will only continue is the combination of various technologies at the module level. There are already a number of module providers that incorporate GPS into the actual WAN radio board. Other technologies that are prime for the same type of integration are Bluetooth and WiFi radios. This type of combined solution greatly reduces end product development and time to market.
4 The Software

A number of software solutions have been developed to support the many applications that have evolved and incorporate the use of wireless systems. The development of software for these applications is typically tailored to the solution and very vertical in nature. Many factors have to be considered to insure that the entire system can function smoothly in what is typically a very challenging environment. There are very few existing systems that can be used in a wireless environment with no modification. Systems that weren’t originally designed for wireless access and/or were modified to accommodate different wireless solutions, may encounter issues in a number of areas.

The challenges that face most solutions include some of the following:

- Network latency
- Bandwidth requirements
- Security
- Network architecture

Specific vertical markets have adopted the use of wireless solutions used in a public network and the demand for such solutions has grown. A cottage industry of software developers has emerged to support the demand in various markets. The following vertical market solutions are among the most popular:

- Public safety
- Fleet management and dispatch
- Automated Vehicle Location
- Telemetry

Various approaches can be taken in this area of deployment. Many specific markets have existing wireless options or the mainstream product has incorporated support for wireless access. Applications that are more vertical in nature will require greater research in order to select the appropriate solution.

Many solutions are developed by the end customer provided that the tools available are open enough to support the effort. Middleware solutions that are more horizontal in design should be considered to maximize the efficiency of development. Implementations that plan on future capability integration and/or modification will benefit most from this type of middleware.

5 The Network

The growth of wireless has been monumental over the past decade. New technologies and capabilities have provided an environment that has proven to encourage the development of unique solutions. Network speeds have increased and rates have dropped. The technologies have converged and many carriers have consolidated to enlarge their network coverage footprint and to capitalize on the popularity of wireless communication solutions. Data services provided by the network operators have grown to include the vertical market integrators and offer a wide array of M2M service offerings. The end result is a much easier integration effort into the customer enterprise.

A unique service has evolved in the industry. The development of the Mobile Virtual Network Operator (MVNO) has emerged. An MVNO buys bulk airtime service from existing network operators and creates service packages that are typically used in large customer deployments. They have the ability to tailor the service and rate plan such that it is cost effective and more efficient for the solution. Generally speaking, the footprint and roaming implications are minimized with the use of an MVNO.
6 The Integration

Most wireless deployments require some level of integration. The combination of software configuration, server setup, tuning, and hardware installation mandate a concentrated effort in order to adequately integrate a specific solution. Integration is usually supported, to some extent, by the vendor who sells the particular component. Over the past few years, integration specialists have emerged that handle all aspects of the entire installation. They typically contract with the end customer and provide the required level of service desired. They are knowledgeable in the areas of software installation, server deployment, network configuration and support, and hardware installation.

Most projects should consider the use of a specialist that possesses experience in many areas of the industry. This will minimize the learning curve and increase productivity as compared to going it alone. There are a number of pitfalls that can be avoided by leveraging the experience of those who have exposure to a wide array of deployments.

The use of tools and/or hardware that integrate as much capability as possible are recommended. This allows the integrator/customer to focus on the actual application logic required to deploy a successful system. If distractions are present, valuable time is spent attempting to solve technology problems instead of addressing the real nature and design of the solution.

7 Conclusion

The result of rapid growth within the wireless industry has created a large opportunity for enhancing many industry solutions. Organizations who desire development of a wireless component need to be aware of all aspects of a typical project. Careful research of the various components required for a deployment is a top priority. The amount of flexibility provided by the component will lead to easier integration and support. It is also important to consider the use of consultants and/or integration specialists that have experience in the particular technology being implemented.

Projects will always have unforeseen issues that cannot be planned. Approaching an integration effort with components, tools, and resources that provide benefits to minimize these potential issues will greatly reduce the frustration level and ultimate cost of the project.