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CREATIVE WIRELESS ELECTRONICS

Choosing between a standard and proprietary wireless protocol

Introduction

There is a bewildering array of choice when it comes to considering between a standard or proprietary wireless technology design. Choosing which route to take needs careful consideration and an analysis of which solution will best meet your needs and requirements. This guide highlights the limitations of using standard protocols and takes you through the main questions you should be asking when making a decision.

Overview

Wireless technology choices

Limitations of standard protocols

The 10 questions you need to ask

Other design factors to consider

Wireless Technology Choices

The table below helps make your choice easier by detailing the main wireless standards available, their features and common applications.

Technology/Standard	Frequency	Range	Features	Common applications
ANT+	2.4 GHz	< 10m	Low power	Health, sports monitoring
Bluetooth (Classic)	2.4 GHz	< 10m up to 100m with higher power	Ubiquity, security	Wireless headset, audio apps
Bluetooth Smart	2.4 GHz	< 250m	Low power, cost effective	Proximity sensing, health & sports monitoring
Cellular	Common cellular bands: 900 MHz, 1800 MHz, 2100 MHz	Several km	Longer range	M2M (Machine To Machine) voice, SMS, consumer data
IEEE 802.15.4	2.4 GHz	10-100m	Multiple protocols available	Wireless networks
IEEE 802.22	470 to 768 MHz	many miles	Designed for white spaces, cognitive radio	Broad, backhaul, not used yet
ISA 100a	2.4 GHz	10-100m	Extra security and reliability	Industrial monitoring and control
NFC	13.56 MHz	< 30cm	Security	Payment, access
Passive RFID	125 kHz 13.56 MHz 902 to 928 MHz	< 1m	Low cost, simplicity	Tracking, inventory, access
6LoWPAN	2.4 GHz	10-100m	Internet access	Monitor and control via internet
UWB	3.1 to 10.6 GHz	< 10m	Low power, high-speed data	Video transfer
WiFi	2.4 to 5 GHz	< 100m	High speed, ubiquity	Local networks, Internet access, broadband
WiMAX	2-11 GHz & 10-66 GHz	< 50km	High speed	Wireless alternative to cable and DSL broadband
Wireless HART	2.4 GHz	10-100m	HART protocol	Industrial monitoring and control
Wireless HD	60 GHz	< 10m	Very high speed	Video transfer
Wireless USB	2.4 GHz	< 10m	Proprietary protocol	HID
Zigbee	2.4 GHz	10-100m	Mesh networks	Home, industry monitoring and control

The limitations of standard protocols

Standard protocols are often a good choice when considering new wireless systems as they are proven and cost-effective. However, it's important to bear in mind their limitations, outlined here.

The push to include lots of features increases complexity

Often the desire to include as many features as possible can make the standard very complex. It then becomes much more difficult for the wireless system to meet the full criteria of the standard. The embedded software needed to implement the standard can also become very complex and bloated, which has cost and usage implications for the final product.

Niche applications are not served well

Some user requirements are only partially catered for with standard protocols. For example, energy-harvesting systems require cut-down and specific protocols to fully cater for their requirements. **EnOcean's (www.enocean.com)** protocol for energy-harvested power sources which have very energy efficient transmissions is one such example.

Many wireless system designers choose to develop wireless systems based on proprietary protocols if standard protocol implementations will be too expensive, either from a licensing point of view, or require too much processing power to meet the budget of the end user. These custom designs are 'lighter' than the standards, lower cost, and meet niche performance and applications by utilsing the wide choice in ISM-band devices and modules available.

The 10 questions you need to ask

Whilst every situation will be different, here is a list of the 10 topics to address before choosing between a standard or proprietary protocol route:

1. Network topology

How many members/nodes will participate in the wireless network and what is the interaction between them?

2. Range

What is the required range between the transmitter and receiver? Is the distance fixed or will it vary?

3. Data rate

What speed will the data be transmitted at? Will it be low speed, such as for monitoring and control, or high speed, such as for video transfer? The lowest speed will usually offer the best reliability and least susceptibility to noise.

4. Low power

Is there a special need for low power consumption? If it is to be battery powered, consider battery size, life, recharging needs, replacement intervals and related costs. Is energy harvesting or solar power a possibility?

5. Common standard

Are there common standards that have to be met with other systems? This could mean crucial changes need to be incorporated.

6. System associations

Does the application need to associate with an existing system? This can affect the protocols needed.

7. Software

What kind of software protocols fit the application best? It's important to find the best solution for the job.

8. Regulations

Are there regulations to be considered? Some wireless technologies require an FCC licence but most wireless technologies for short-range applications are unlicensed.

9. Security

Do you need inbuilt security measures? Most wireless standards have security measures available including encryption and authentication.

10. Budget

How much time, resources and budget do you have to get the product to market? You need to be practical and realistic about the development needed.

Other design factors to consider

As well as the questions above, there can often be additional design features that will affect the wireless technology route you take:

The Antenna – this can suffer from loss of efficiency due to the effect a human body and other structures have on the electromagnetic performance

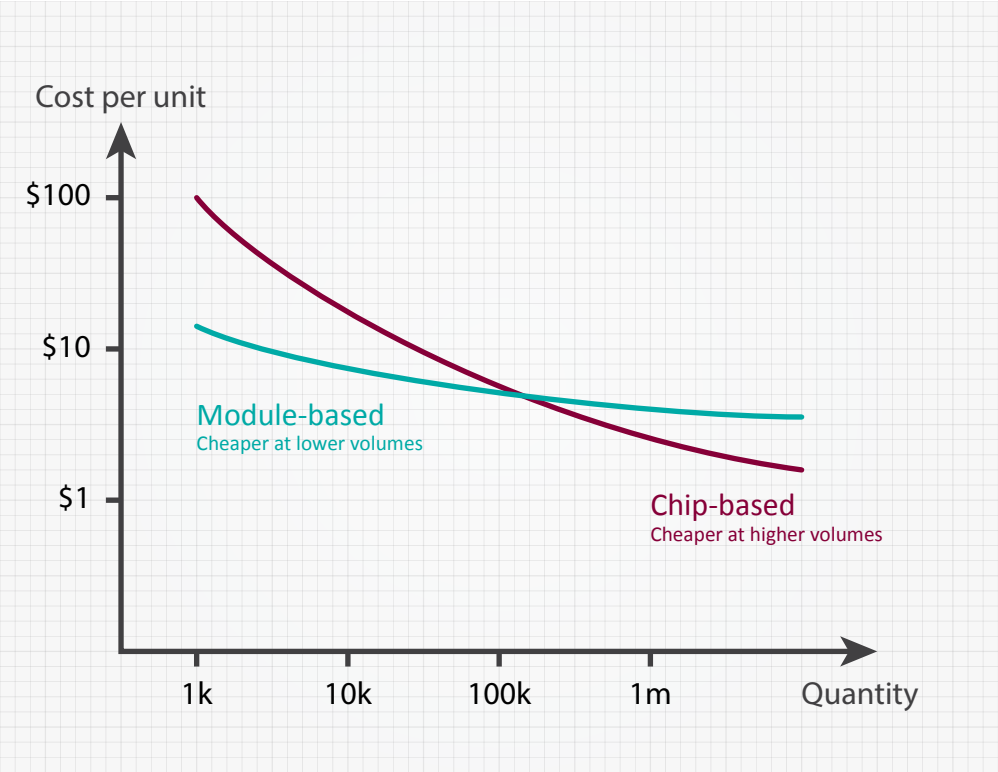
Sensitivity – it's advisable to find the lowest input power with acceptable link quality (typically less than 1% message loss)

Channel Selectivity – how well does a device work in an environment with interference?

Environment - will the system be used indoors or outdoors? Will there be line of sight? Are there any obstructions, reflections or multi-path fading?

Size and space - is there space for the components? What antenna will you be able to use

A further factor to consider is the benefit of choosing a module based solution compared to a self-development based on a chipset. The benefits of selecting a module-based solution include a shorter time to market, potential certification re-use and the device being a field-proven technology in terms of temperature, and antenna loads, for example. The indicative costs graph below shows the benefit at various quantities:



Conclusion

Technology based on standard wireless protocols will often present a cheaper and easier to implement option but won't necessarily offer the best solution for the project needs. Equally, a proprietary protocol solution is more likely to offer all the solutions required but will cost more in terms of development and implementation.

Choosing either a standard or proprietary wireless technology comes down to some basic factors.

You should choose a **standard protocol** if:

- Your wireless system application is a close match to the purpose of the wireless standard
- Your development budget is low or system designers are not available

You should choose a **proprietary protocol** if:

- There is a need for low cost hardware using a low footprint (small memory usage) protocol
- If there is not a good fit between your wireless system application and the protocol or if a standard protocol has to be 'shoehorned' into the system design

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ASH can offer a free consultation to help assess your wireless system design needs so you can make an informed choice.

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