ISCE

The Institute of Sound and Communications Engineers

Engineering Note 29.1

Analogue or Digital?

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Analogue or digital?

Actually, the title should be 'Analogue or digital or both?'. Human beings only have analogue audio input and output, so if the equipment has to interface with them, it has to have analogue interfaces even if the core is digital.

Digital devices are so low in cost these days that almost every design requires the 'analogue or digital' decision. It *really doesn't* pay to make the wrong guess. So how do we arrive at an 'informed decision' rather than a guess?

SWOT analysis (Strengths, Weaknesses, Opportunities and Threats, see, for example, http://en.wikipedia.org/wiki/SWOT_analysis) is a useful tool for this purpose, even though it is discredited as a corporate planning tool (maybe because in many cases it was incorrectly implemented). SWOT includes factors within and external to the company, and for the latter the analysis tool PEST (Swat - pest - geddit?): (http://en.wikipedia.org/wiki/PEST) or one of its developments, from PESTLE to STEEPLED, can be used. PESTLE is 'Political, Economic, Sociological, Technological, Legal, Environmental'. There is a lot more information about SWOT at:

http://www.rapidbi.com/created/SWOTanalysis.html

This is the sort of thing that could be a three-volume novel or a simple table. Guess which one I'll chose, without a SWOT analysis!

SWOT analysis table

Strengths	Opportunities	Weaknesses	Threats

SWOT usually classifies strengths and opportunities as 'internal' and 'weaknesses' and opportunities as 'external', but for the present purpose, that isn't really useful. For example, a weakness may be 'shortage of analogue designers', while a strength may be 'competitors have limited experience in selling digital products'.

You make one of these tables for the analogue solution, and another for the digital solution, and compare them. While the blank table shows just four rows, you will probably need more, BUT if you need more than ten, you are probably analysing too minutely and the exercise won't work - too confusing.

You probably won't need to have a PESTLE table, because most of its topics can be included in your SWOT tables:

Political

Governments change infrastructures; an example is the Digital Dividend's effects on radio microphones.

Economic

What price will people pay under the current conditions? Do we need a loan to buy a pick-and-place machine?

Sociological

What is the public perception of this product ('likely' perception if it's totally new)? Is 'digital' a selling-point?

Technological

Continued availability of devices? New display technologies?

Legal

European Directives, national regulations at home and abroad.

Environmental

RoHS, WEEE, REACH, energy consumption …. a growing list.

It isn't as simple as that!

Very often, there are four (or is it three and a half?) options - pure analogue, pure digital, mixed digital and analogue and digitally-controlled analogue. This fourth option can be very attractive, because it has most of the advantages of analogue with fewer of the disadvantages of digital, or has them to a much lower degree. The following *general* table should **not** be used as a starting point for your own analyses; it's only to show a *general* comparison of 'features', whether positive or negative.

General comparison table

Analogue		Digital		Mixed (in signal chain)		Digitally-controlled analogue	
Strength	Weakness	Strength	Weakness	Strength	Weakness	Strength	Weakness
Simplicity; short development time	Accuracy	Accuracy	Software as well as hardware; long development time	Versatility	Long development time	Precise control	Software development time, but may be short (e.g. PIC)
Few EMC issues; maybe no testing needed	Inflexibility	Flexibility by changing software	EMC issues		EMC issues, including internal EMC of digital and analogue parts		EMC issues, but fewer because of low data rates
	Remote control difficult	Remote control possible	Complexity: field servicing often requires modular construction	Remote control possible	Complexity: field servicing often requires modular construction	Remote control possible	

Why isn't cost mentioned?

Because in the general case, it's not possible to say which of the four possibilities has the most attractive overall cost. There is no point in having a low-cost design if it needs £50 000 of production test equipment or third-party testing.