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Mobile-TV in China

Emerging Standards and Technologies.

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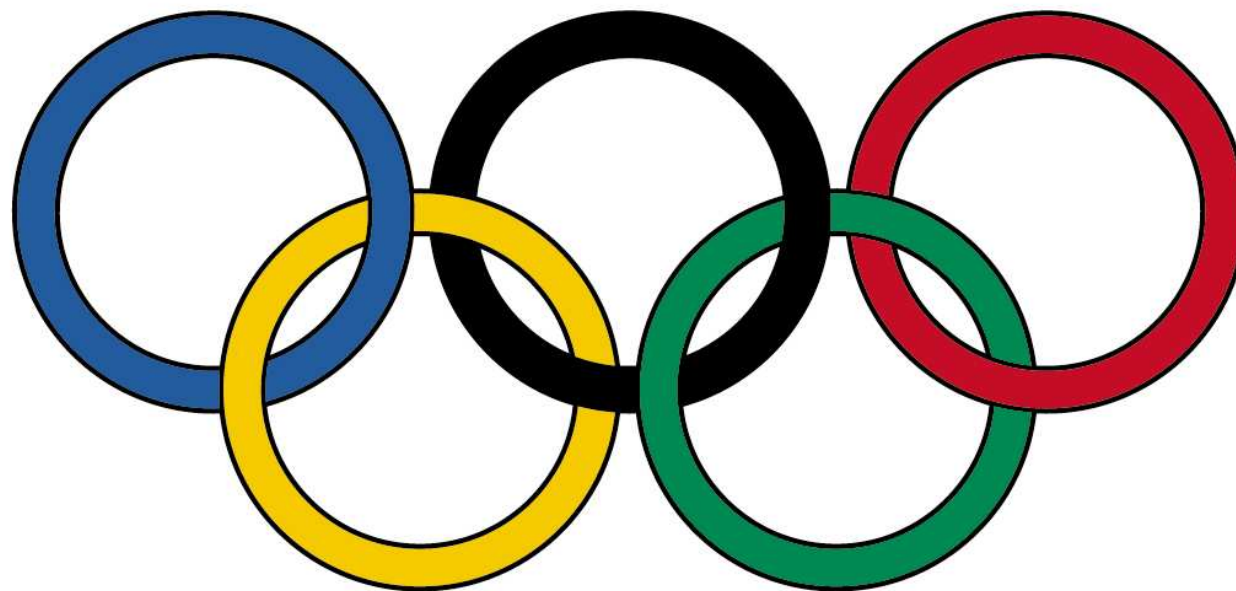
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China's Mobile-TV Agenda

- CMOS **Emerging Technologies**.
- Other factors play a role in technology development and adoption:
 - Political forces. Government subsidization, legality.
 - National pride.
 - Internal education and employment policies.
- All the above have a role to play in China's agenda regarding Mobile-TV standards.

China's Mobile-TV Agenda

- One more very important thing has played a major part in China's recent drive to develop novel wireless communication standards.



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China's Olympics

- A major source of national pride.
- Identified as an opportunity to showcase the country.
- A “coming of age” of China as a developed country, capable to being at the cutting edge of technological development.
- Note quite true on all counts (yet) but close and getting closer every year.

The impact on China's mobile-TV roadmap

- The Olympics and China's desire to home-grown indigenous communications skills and standards has led to a number of interesting developments.
 - Adoption of a Chinese specific 3G standard (TD-SCDMA).
 - Adoption of a Chinese specific terrestrial TV standard (D-TMB).
 - Adoption of a Chinese specific mobile-TV standard (CMMB/STiMi).
- All these home-grown standards are aggressive in terms of the technology used (high modulation, advanced error correction)
- But why develop internal standards at all?

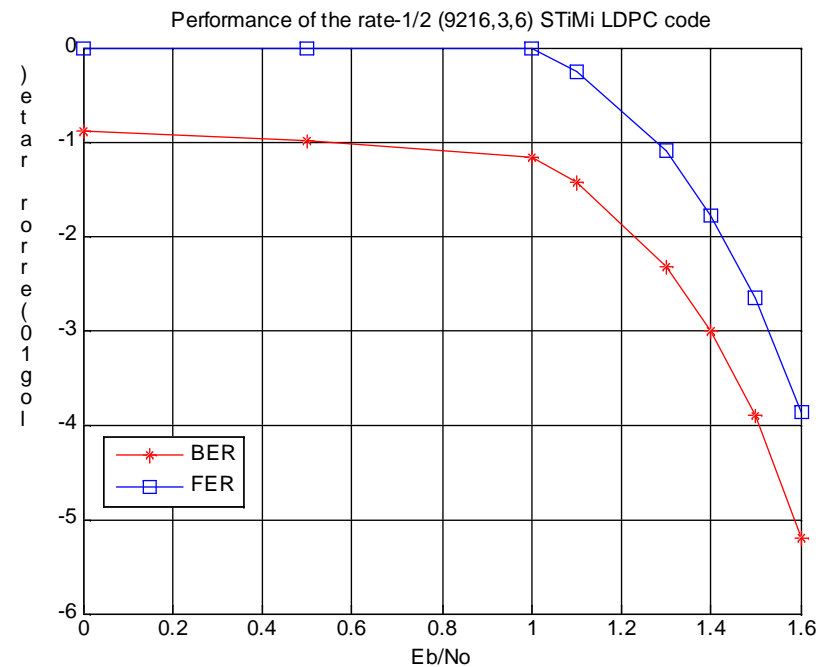
Why China wants its own standards

- New, Chinese specific standards mean several things:
 - Jobs and opportunities of indigenous semiconductor companies.
 - Results in homegrown dies for China's expanding foundry businesses.
 - Despite the boom in in-house design centers in China, semiconductor imports are still growing and in 2007 China imported about \$6.5 billion worth from the US alone.
 - A barrier to entry for non-Chinese companies through translation issues, IP issues and test facility issues.
 - Avoids royalty payments for existing US, European or Asian standards.

Item	S-DMB	T-DMB	DVB-H	TiMi
Frequency band	2.6 GHz	Band-III & L-band	UHF & L-band	30 ~ 3000MHz
Channel BW	25MHz	2 MHz	4,5,6,7,8MHz	2 MHz or 8 MHz
Modulation	DSSS with QPSK	OFDM with DQPSK	OFDM with QPSK, DQPSK, 16QAM, 64QAM	OFDM with BPSK, QPSK, 16QAM, 64QAM
FFT size (for OFDM)	N/A	2048	2K, 4K, 8K	1024 for 2MHz 4096 for 8MHz
Effective usage of bandwidth	62 %	75%	95 %	94 %
OFDM symbol length	N/A	1 ms	8 MHz, 4K, GI=1/8: 504 us	8MHz: 463.2 us
Innter code	Punctured convolutional code	Punctured convolutional code	Punctured convolutional code	LDPC with R=1/2, 3/4
Outer code	(204,188) RS code with convolutional interleaver	N/A for Audio (204, 188) RS code with convolutional interleaver for Video	(204, 188) RS code + MPE-FEC (RS code with block interleaver)	(240, K) RS code with block interleaver
Diversity	Mandatory	Not mandatory	Not mandatory	Should be necessary
Data rate (DQPSK/QPSK, code rate = 1/2)	7.6 Mbps	1. 15 Mbps	8MHz, 4K, GI=1/8 5.53 Mbps	8MHz: 5.57 Mbps
Time interleaver	Up to 6.5 sec	384 ms	N/A MPE-FEC works as time interleaver	N/A (240, K) RS code works as time interleaver
Output data format	MPEG TS	MUSICAM for audio, MPEG TS for video	MPEG TS + IP broadcasting	N/A

STiMi Performance

- $N=9216$. $R=1/2$ or $3/4$.
- Quasi-Cyclic structure means an algebraic structure:
 - Eases memory structure.
 - Ensures performance metrics.
- Here is $R=1/2$ code simulated on an AWGN channel with BPSK modulation.
 - No obvious error floor.
 - $1e-5$ at about 1.6dB with full precision BP decoding



Raithlin's Story

- We were approached by a Korean fabless semiconductor to develop STiMi decoders for their CMMB offering.
- They felt they were in a good position to attack this market because they had a working DVB-H solution.
- Only large missing piece was a ~6 MBPS LDPC decoder to be provided by us.

Raithlin's Story

- After successfully developing a functional prototype the project was put on hold as we waited for the deployment situation to clarify.
- Chinese companies (Infodei and Telepath) both announced working silicon, as did the Israeli company Siano.
- However for reasons that are not quite clear Echostar are now refusing to launch the StiMi satellite! They took a \$100 million charge for this refusal.
- Now China claims it will launch its own satellite. However this could take several years and requires access to rad-hard chips currently on the US restricted list.
- All I can say is “bummer”.

Conclusions and Morals

- China is a huge market with a desire to develop new technologies.
- Its standardization process is convoluted and political. Make assumptions at your peril.
- We will continue to make forays into this market because, in the longer term, there is massive potential there.
- In the meantime, does anyone want to buy a decoder for a satellite system with no satellite?