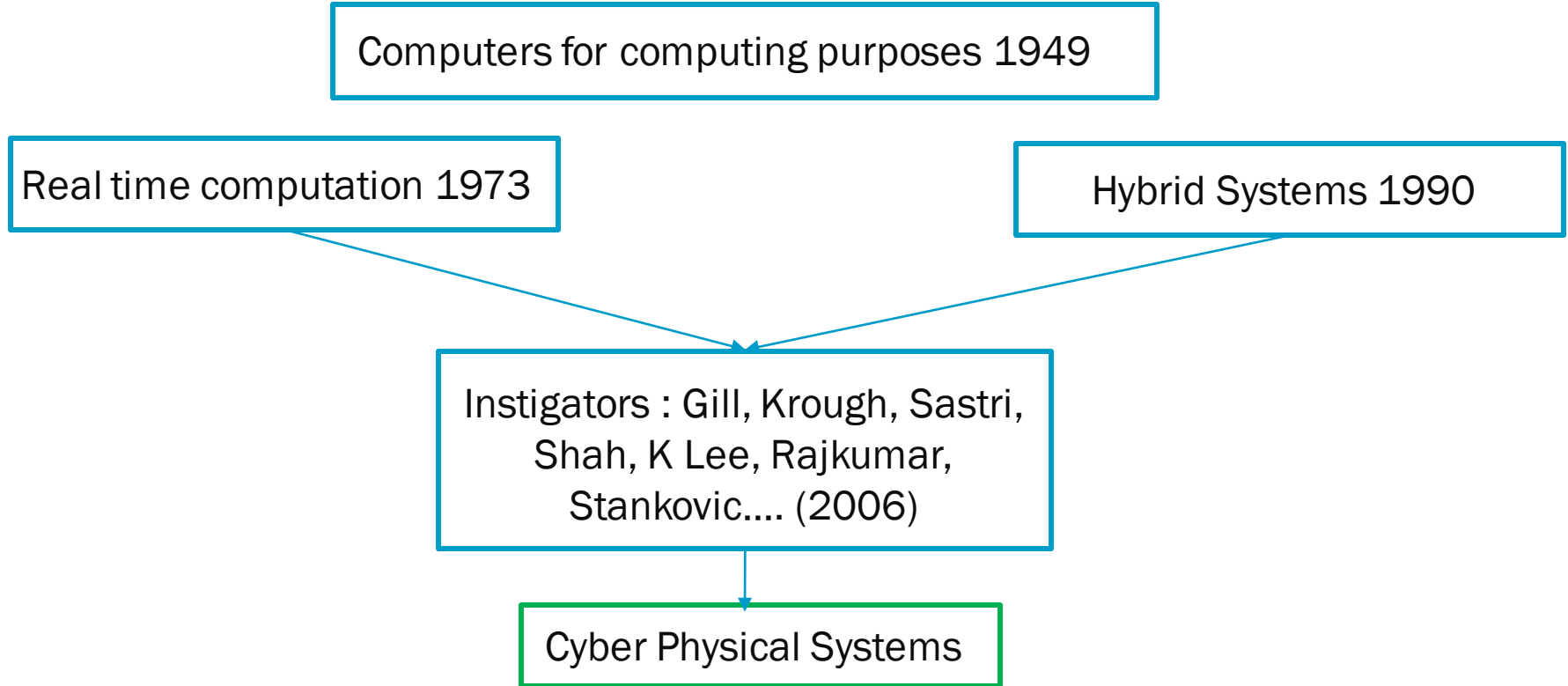




An Introduction to 802.15.4e

John Harrison Kurunathan

Cyber Physical Systems

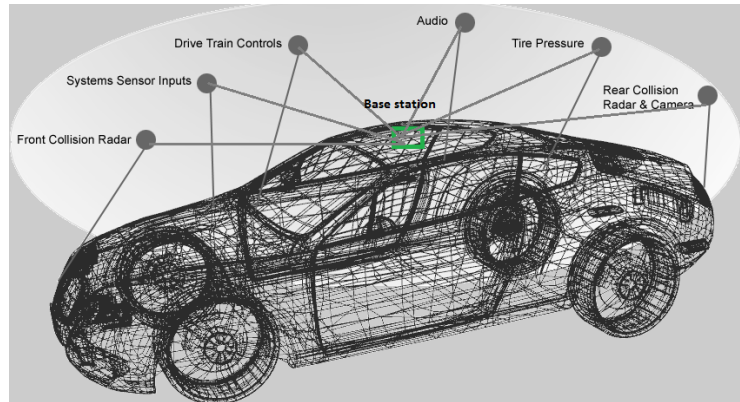


Wayne wolf, Article on EMBEDDED COMPUTING, . "Cyber-physical systems." (2009).



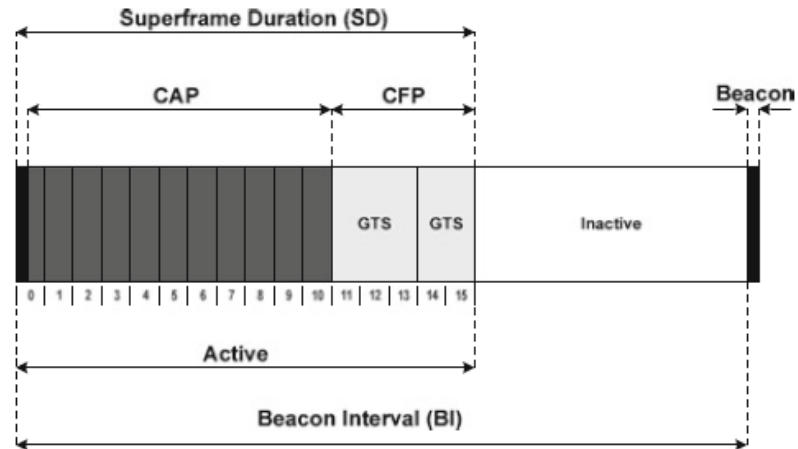
Motivation

- Automobile industries
- Domestic industries



802.15.4

- What and why – A standard ?
- Channel access methods : beacon, non-beacon
- CSMA CA
- Guaranteed time slots
- Non beacon mode



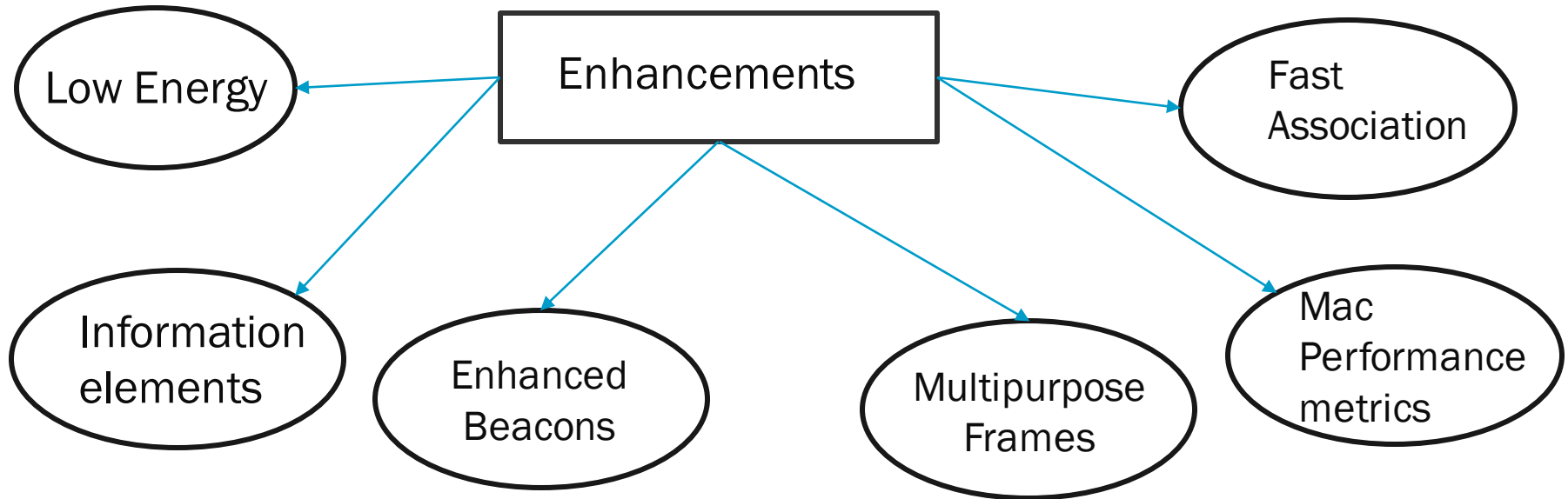
Limitations of 802.15.4

- Unbounded delay
- Limited communication reliability
- No protection against interferences/fading
- Powered relay nodes



802.15.4e

Abstract: IEEE Std 802.15.4-2011 is amended by this standard. The intention of this amendment is to enhance and add functionality to the IEEE 802.15.4 MAC to (a) better support the industrial markets and (b) permit compatibility with modifications being proposed within the Chinese WPAN.

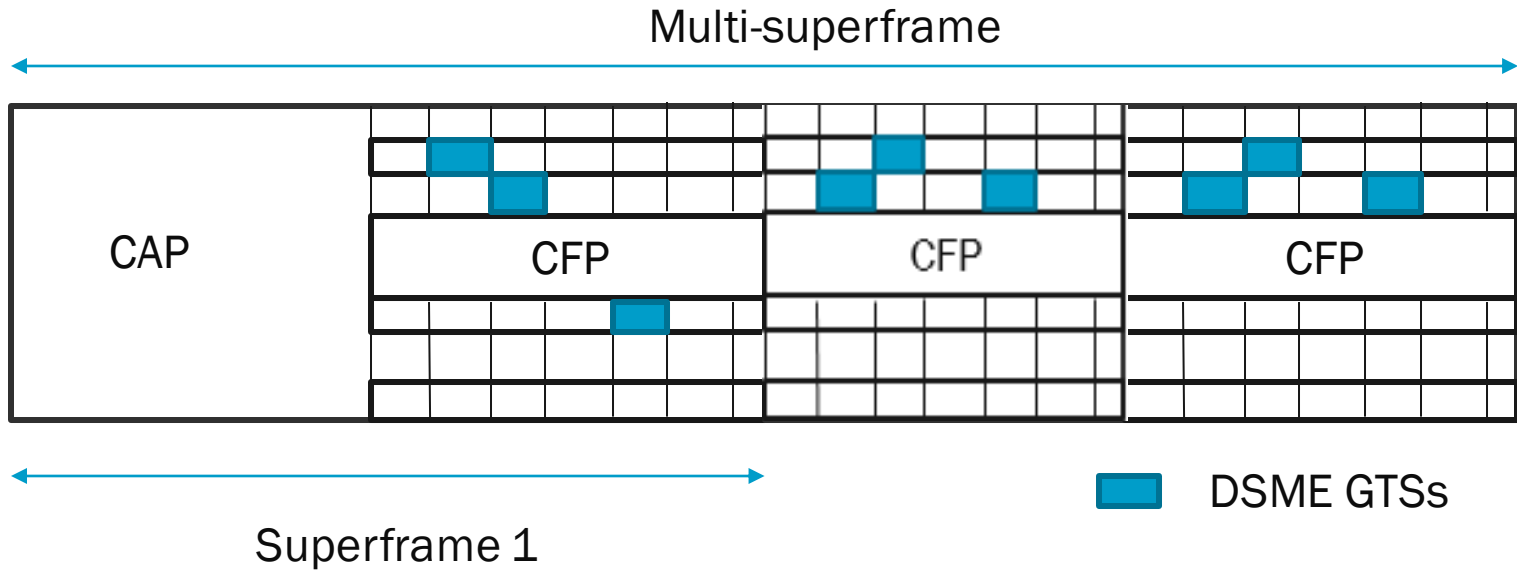


MAC Behaviors

- Radio Frequency Identification Blink (BLINK)
- Asynchronous multi-channel adaptation (AMCA)
- Deterministic and Synchronous Multi-channel Extension (DSME)
- Low Latency Deterministic Network (LLDN)
- Time Slotted Channel Hopping (TSCH)

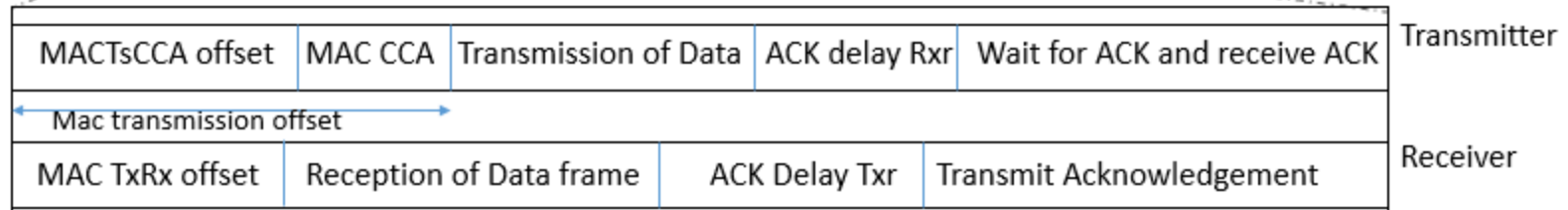


DSME



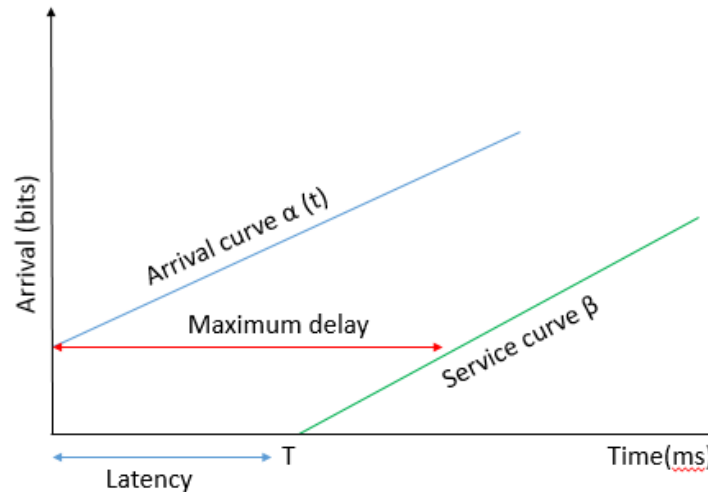
TSCH

ASN=0	ASN=1	ASN=2	ASN=3	ASN=4	ASN=5
Ts1 A->B	Ts2 B->C	Ts3	Ts1 A->B	Ts2 B->C	Ts3

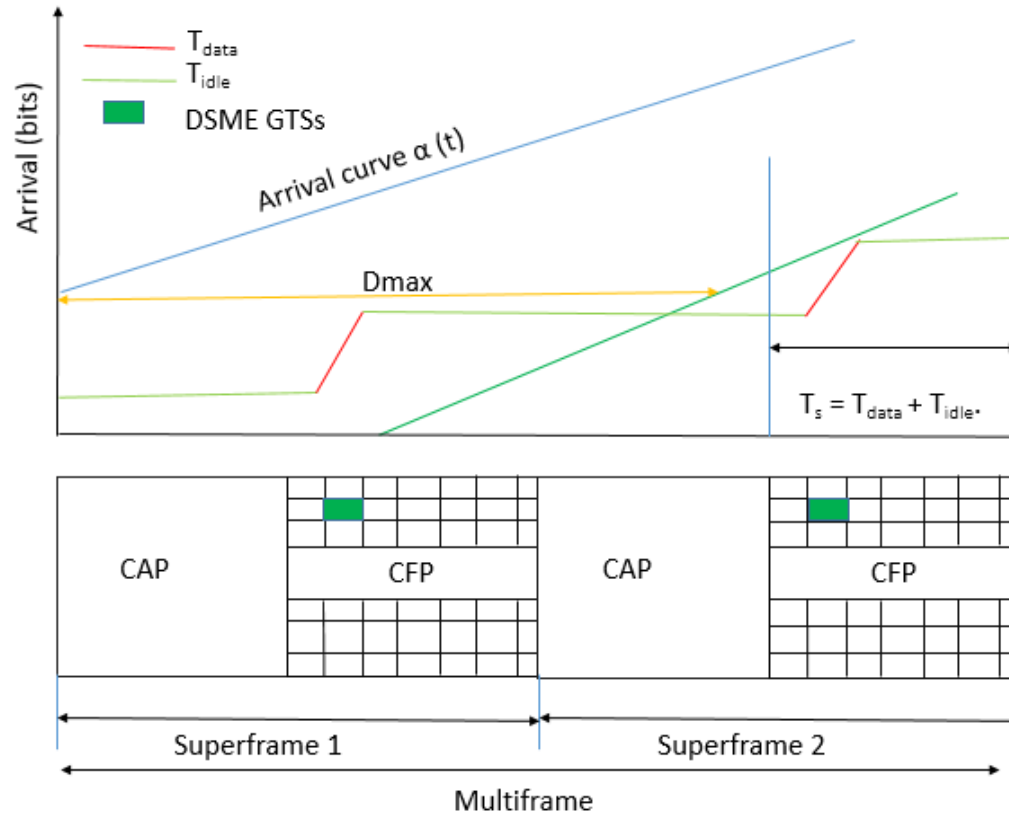


Network Calculus

- In order to correctly address the demands in terms of latency and resources, it is mandatory to carry out a thorough network planning.



Delay model of DSME



Future Work

- We plan to develop Models for all the MAC behaviors to calculate their respective worst case delays
- We are currently working on an implicit allocation of nodes in guaranteed time slots which would reduce the delay.



References

1. IEEE standard for information technology, WPANs- Part 15.4 amendment 1: Mac sublayer,” IEEE Std 802.15.4e-2012 (Amendment to IEEE Std 802.15.4-2011), April 2012.
2. IEEE standard for information technology, WPANs Part 15.4 IEEE Std 802.15.4-2006 (Revision of IEEE Std 802.15.4-2003), Sept 2006.
3. A. Koub^{aa}, M. Alves, and E. Tovar, “Energy and delay trade-off of the gts allocation mechanism in ieee 802.15. 4 for wireless sensor networks,” International Journal of Communication Systems, vol. 20, no. 7, pp. 791– 808, 2007.



Thanks !!

