

LIUPPA – 19 Mai 2011

Couche MAC et protocole CL-MAC pour RCSF



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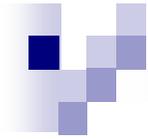
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Date de la dernière modification : 19/05/2011



Plan

- **Introduction**
- **Sources de gaspillage d'énergie**
- **Classification**
- **CL-MAC**
 - **Présentation**
 - **Vulnérabilité**
- **Conclusion et perspective**

Introduction (1)

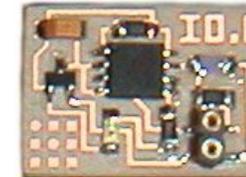
Main frame



1974



RFID



2004

Vers ?

- Miniaturisation
- Économie d'énergie
- Faible coût
- Nouvelles applications Industrielles et sociétales

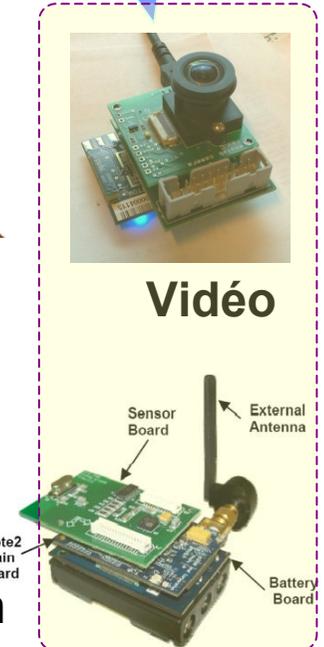
Scalaire

1ere génération



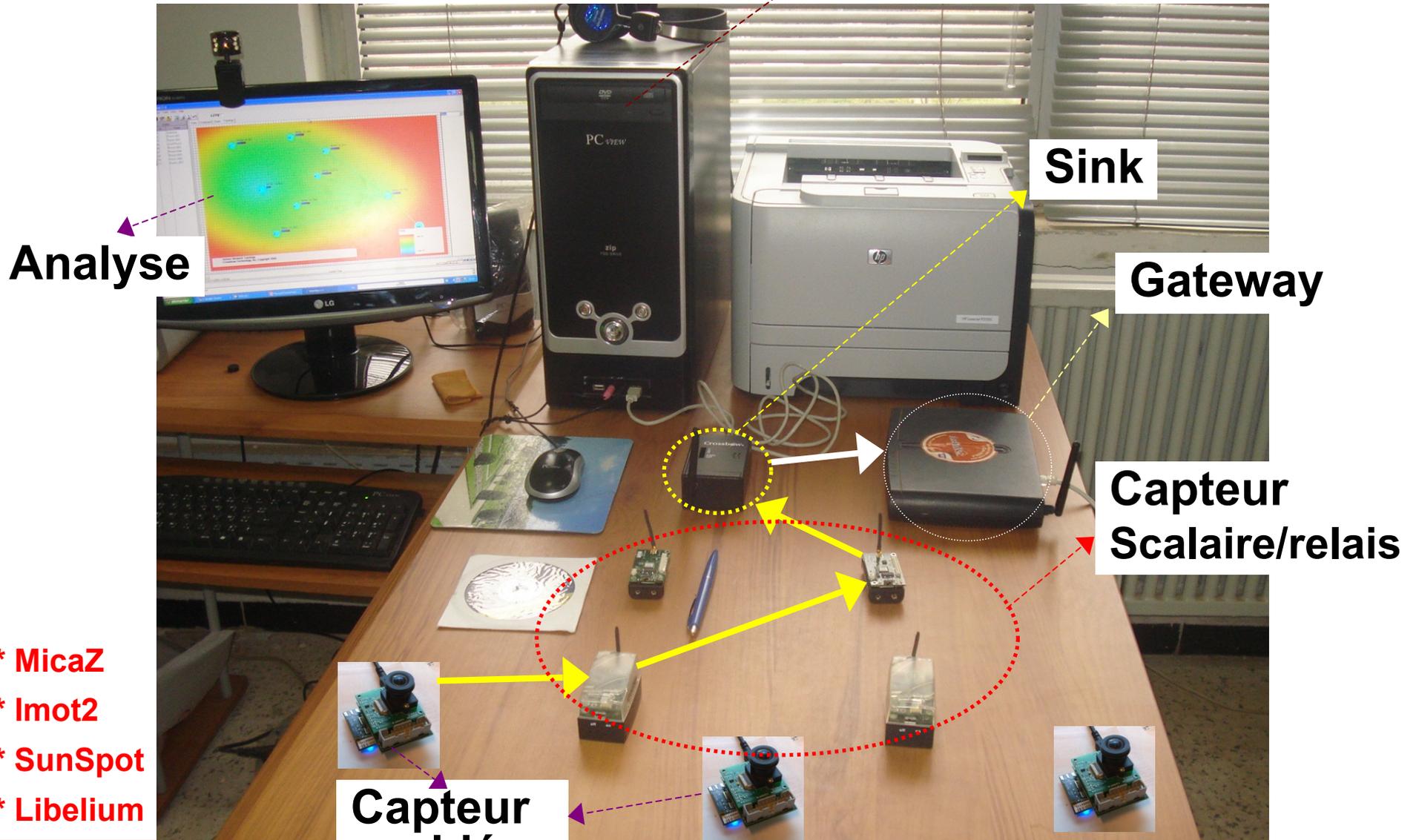
Scalaire

Nlle génération

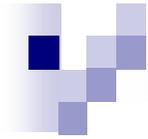


Vidéo

Exemple de RCSF — Traitement



- * MicaZ
- * Imot2
- * SunSpot
- * Libelium



Métriques de performance - MAC

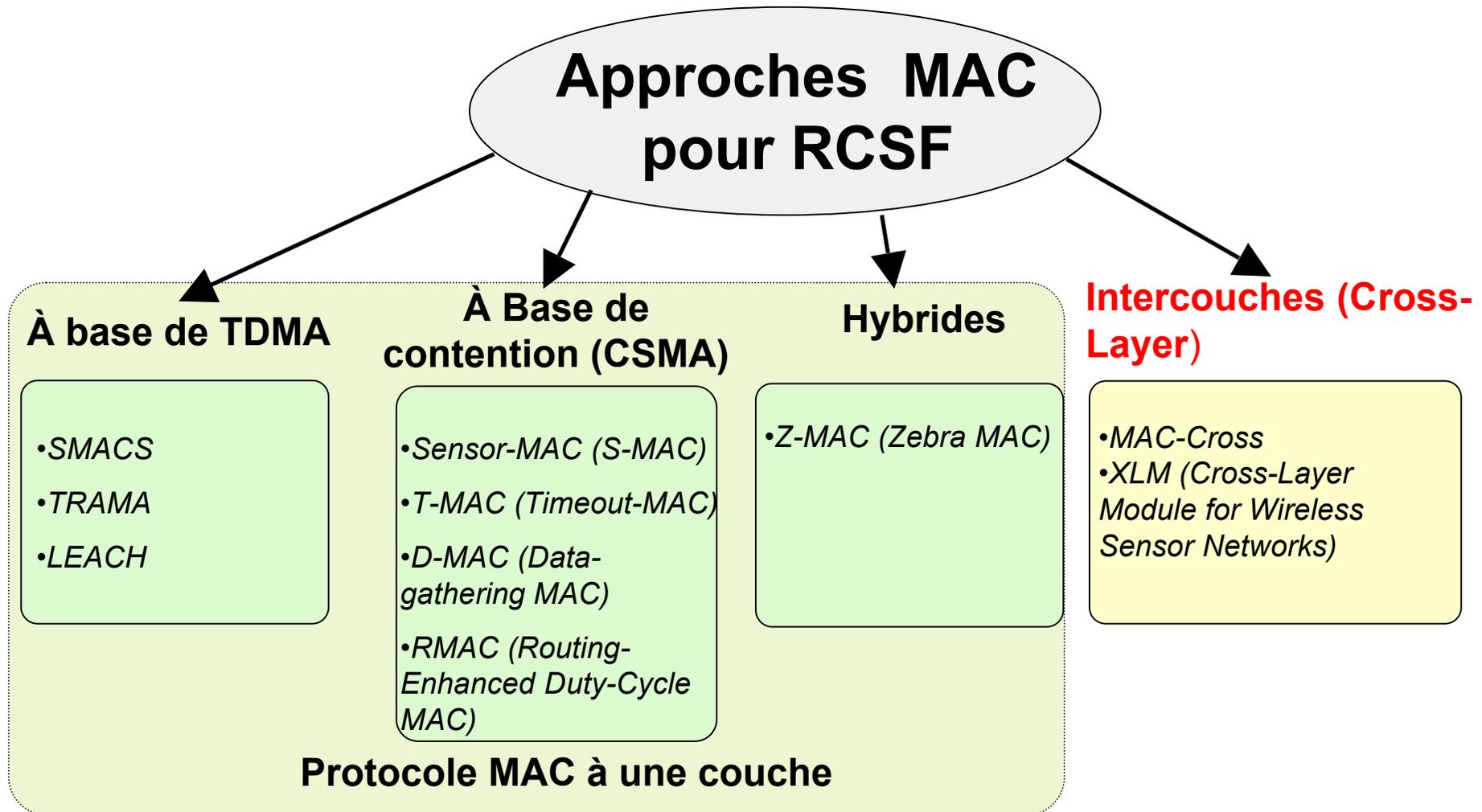
- **Énergie**
- **Latence**
- **Autres!**

Principe (1)

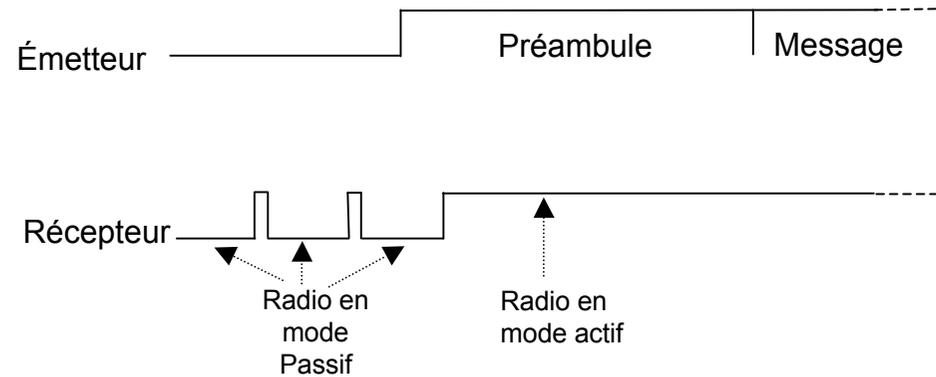
Sources de gaspillage d'énergie au niveau MAC

- Réception indésirable (*overhearing*)
- Collision
- Paquets de contrôle (*overhead*)
- Écoute de la porteuse à vide (*idle listening*)
- Non disponibilité du récepteur (over emitting)

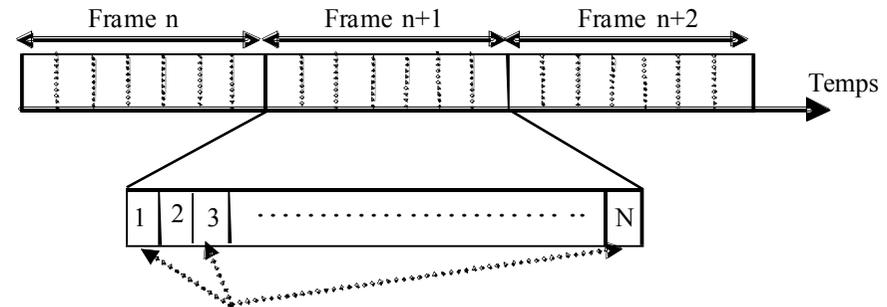
Classification



Approches basées sur le préambule



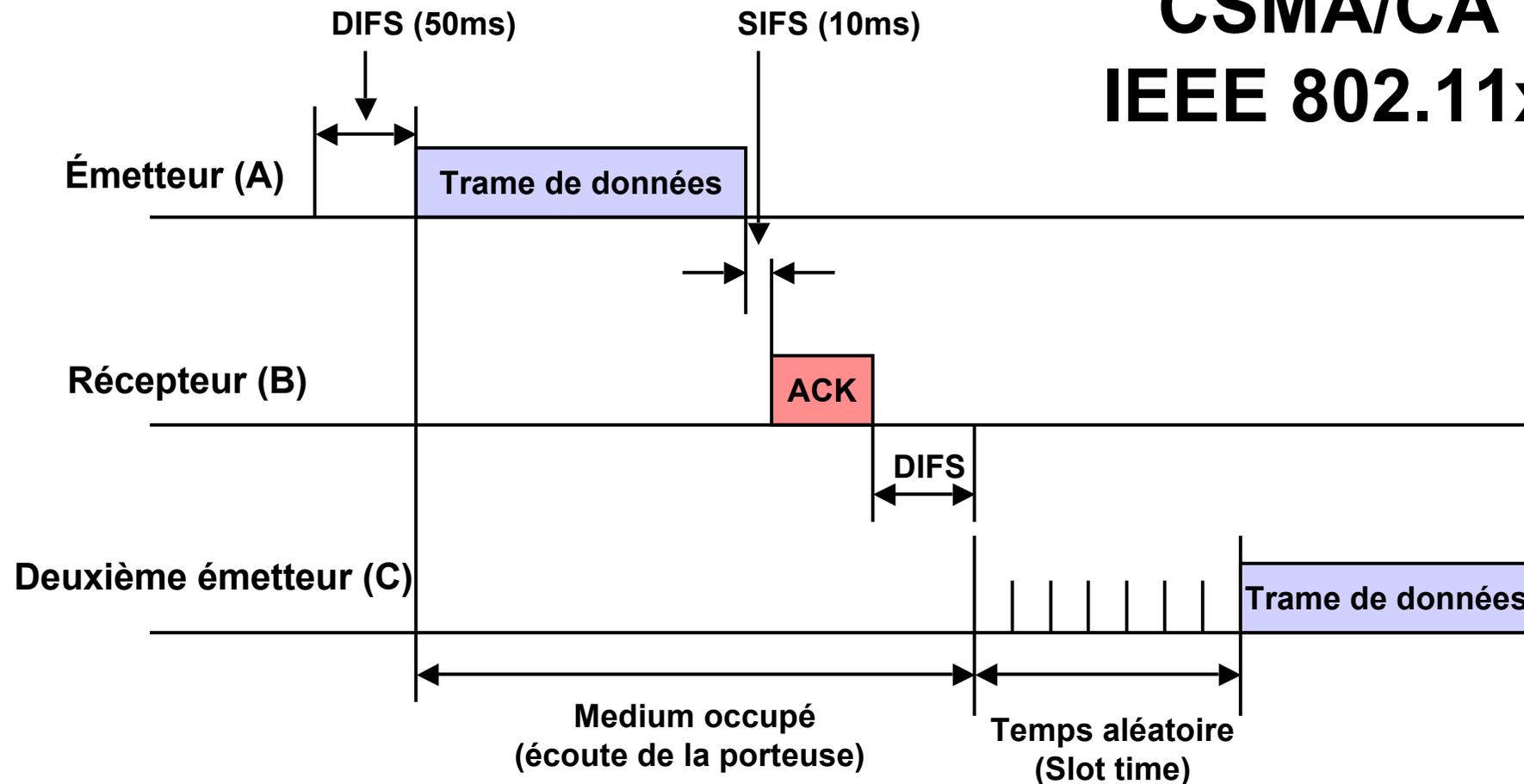
Approches basées sur TDMA



Tranche 1, 3 et N : intervalles de temps assignés au nœud capteur S

Approche à base de contention (1)

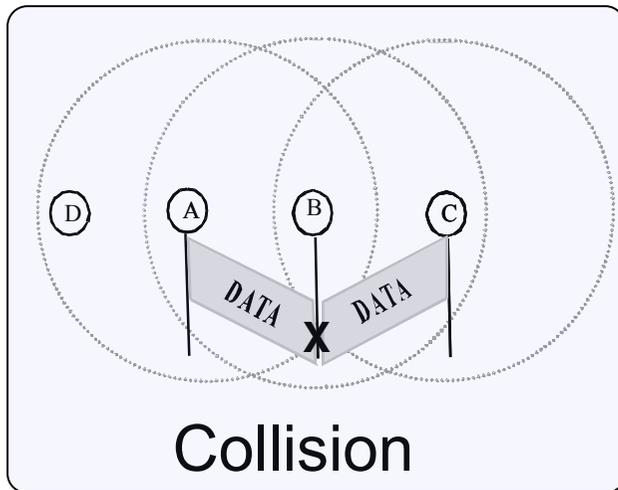
Méthode d'accès CSMA/CA IEEE 802.11x



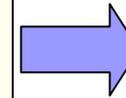
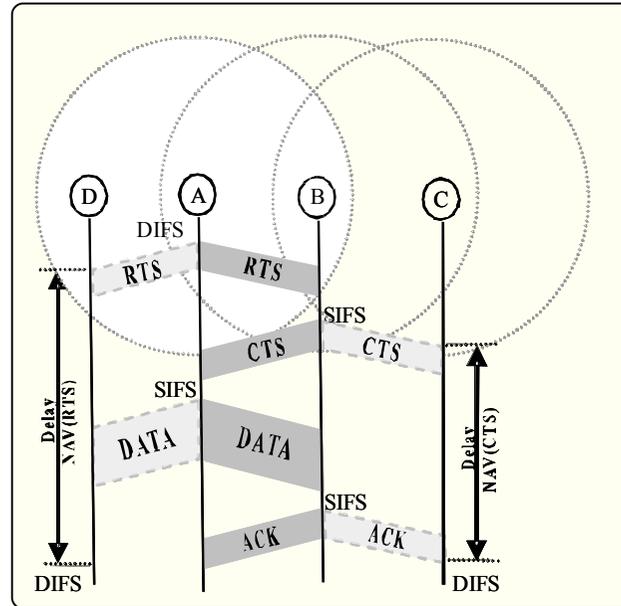
DIFS: DCF (Distributed Coordination Function) Inter Frame Space

SIFS: Short Inter Frame Space

Approche à base de contention (2)

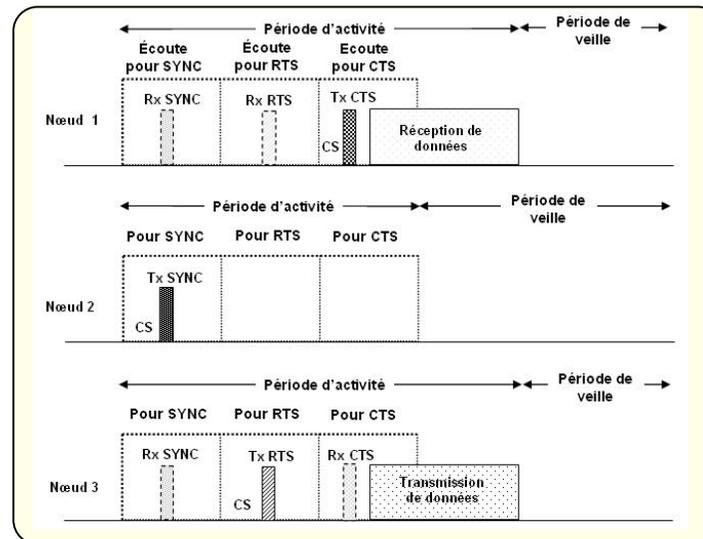


Sol.



802.11x
avec
RTS/CTS

S-MAC

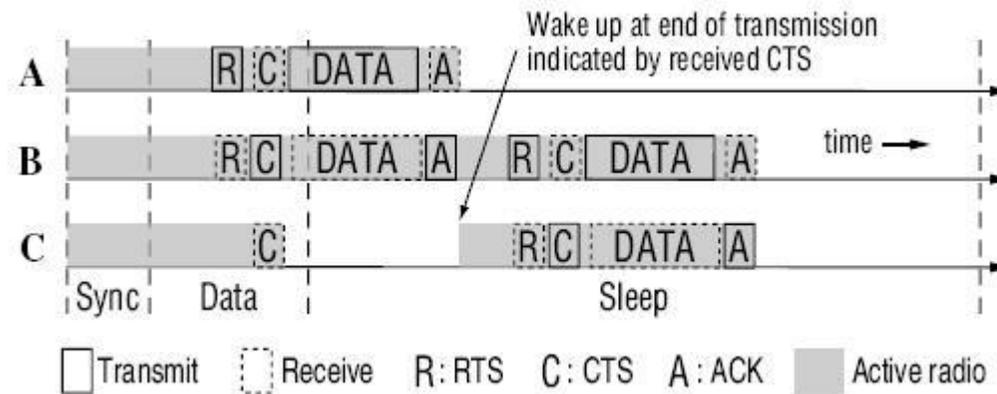


Autres approches:
T-MAC, D-MAC, Z-MAC
(hybride), ...

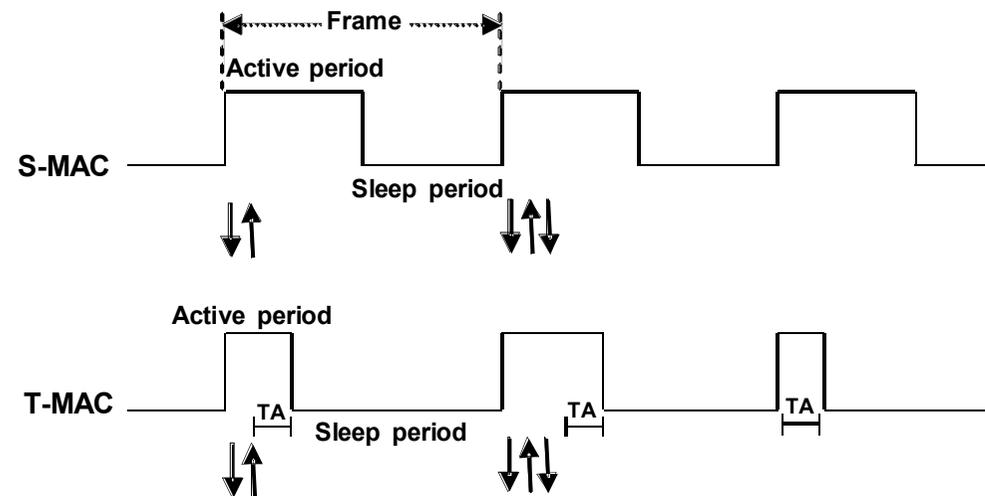
Approche à base de contention (3)

Amélioration de S-MAC

S-MAC avec écoute adaptative de la porteuse

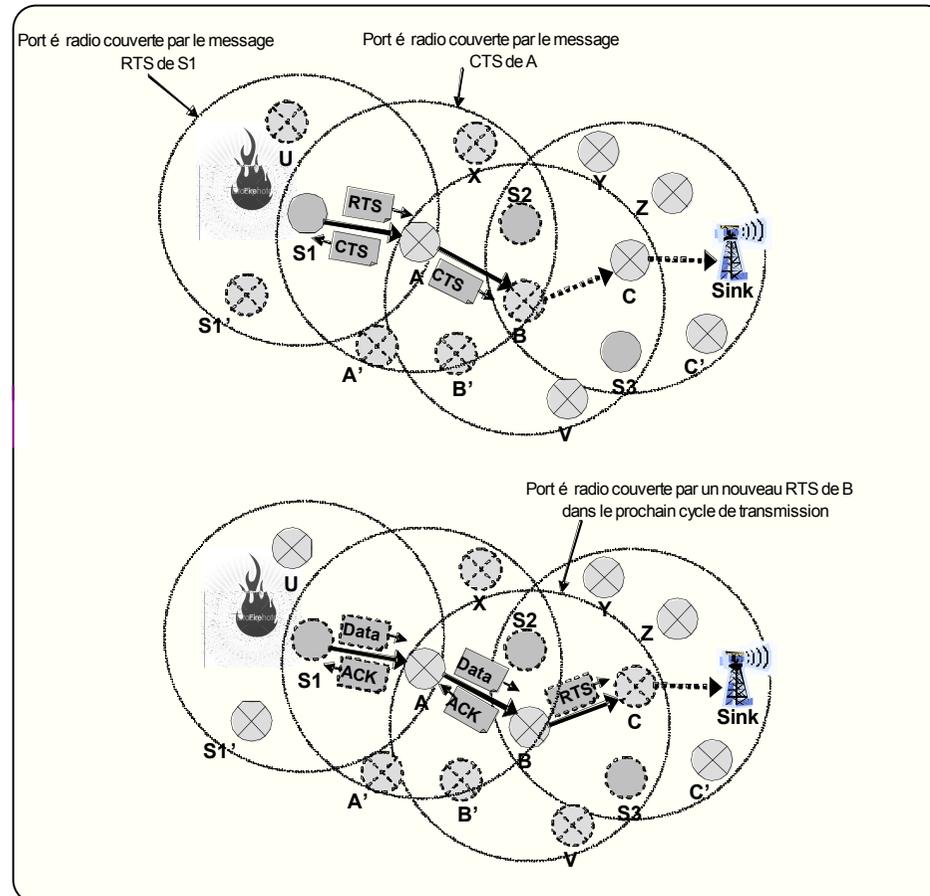


T-MAC

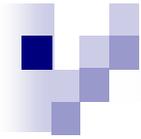


Approche inter-couches

MAC-CROSS

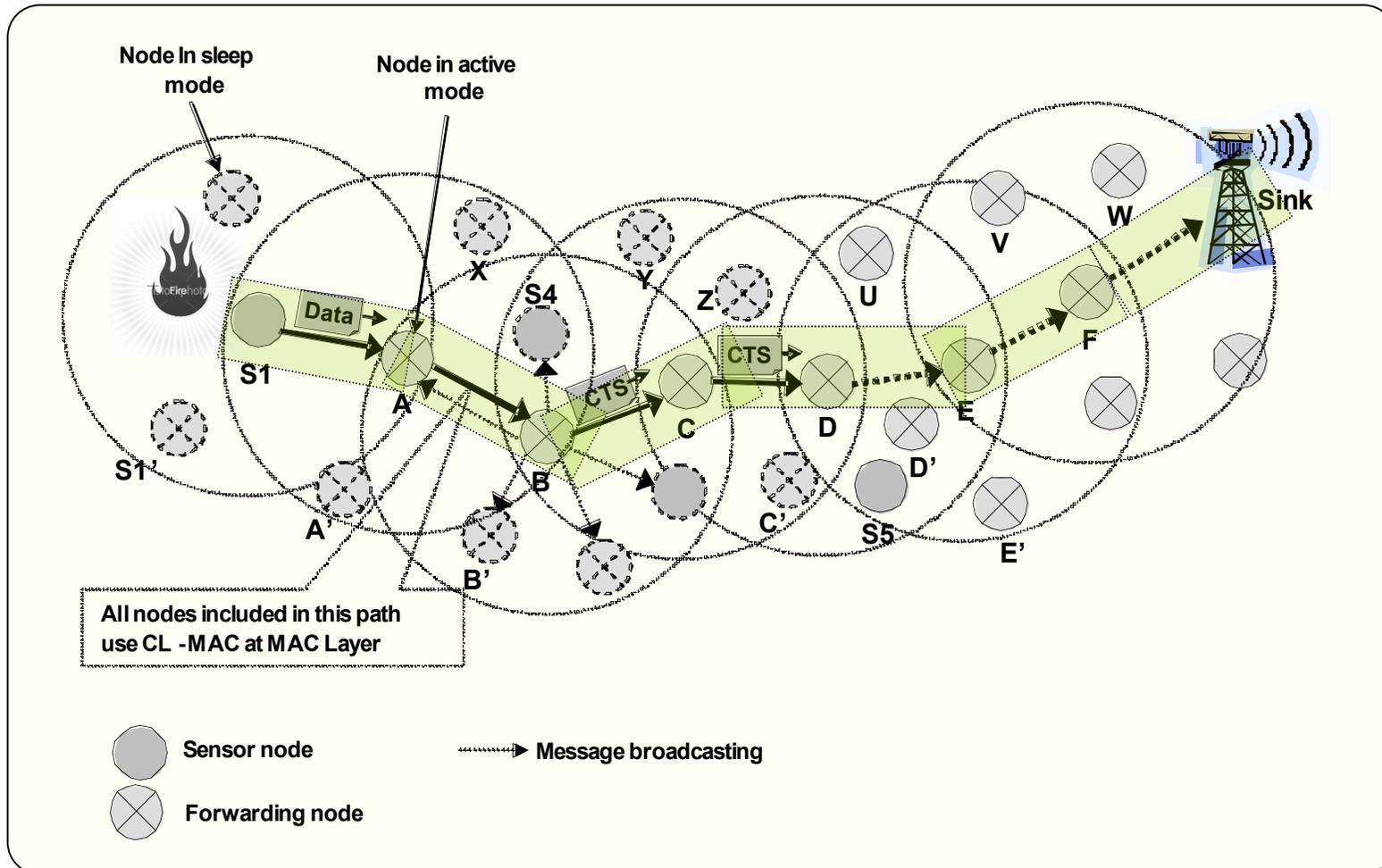


Autres approches: **XLM** (*Cross-Layer Module for Wireless Sensor Networks*), ...

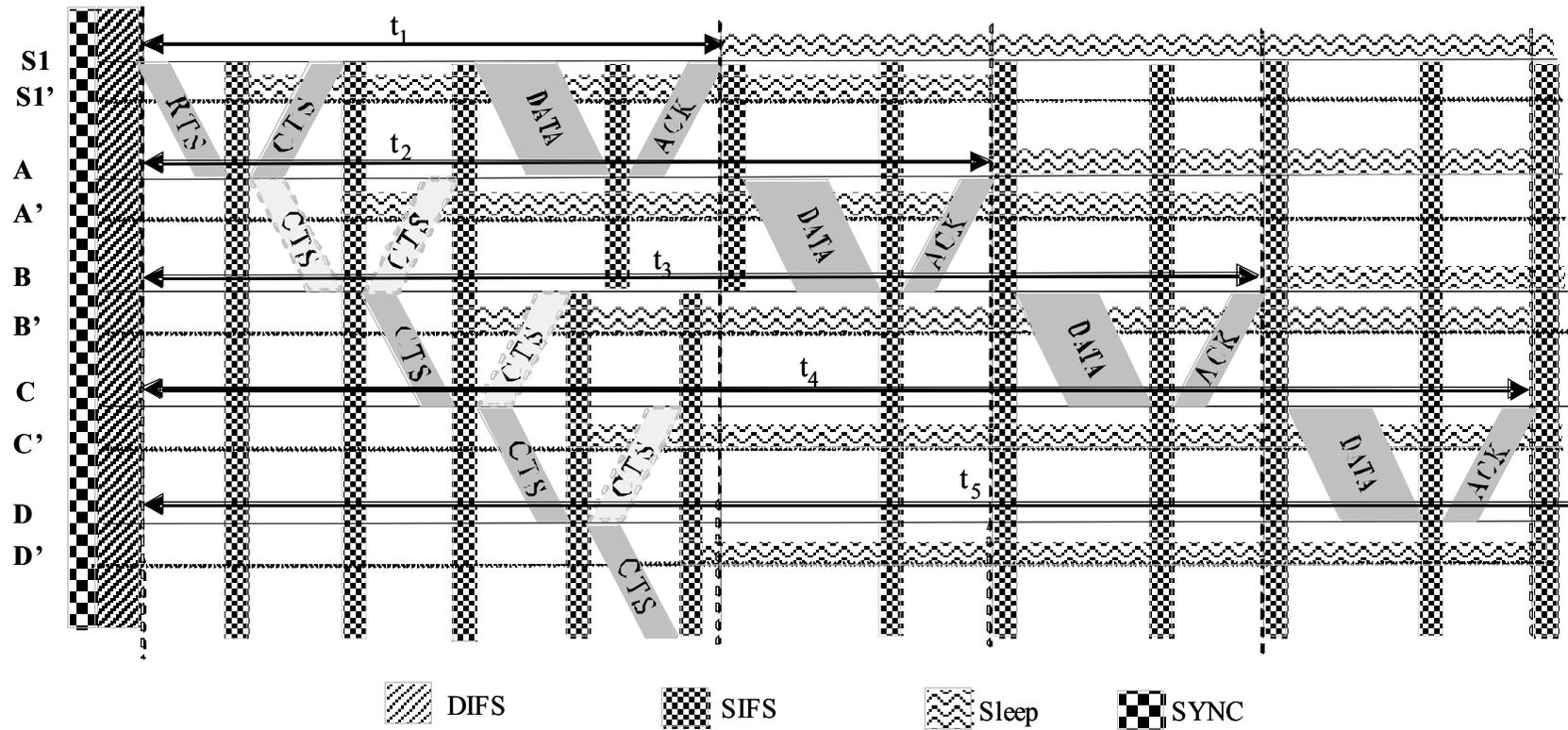


CL-MAC (1)

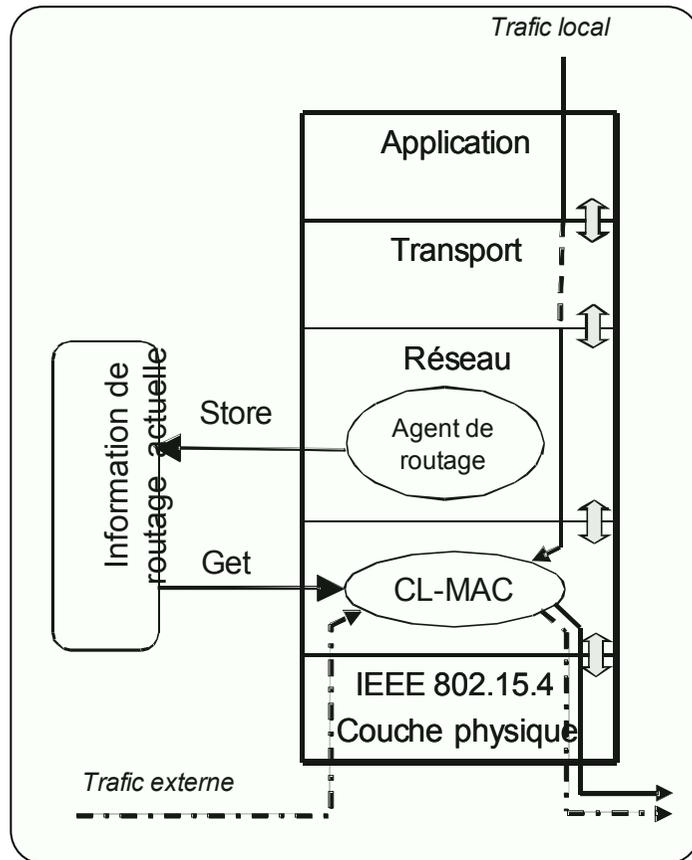
Notre proposition



CL-MAC : comportement temporel (2)



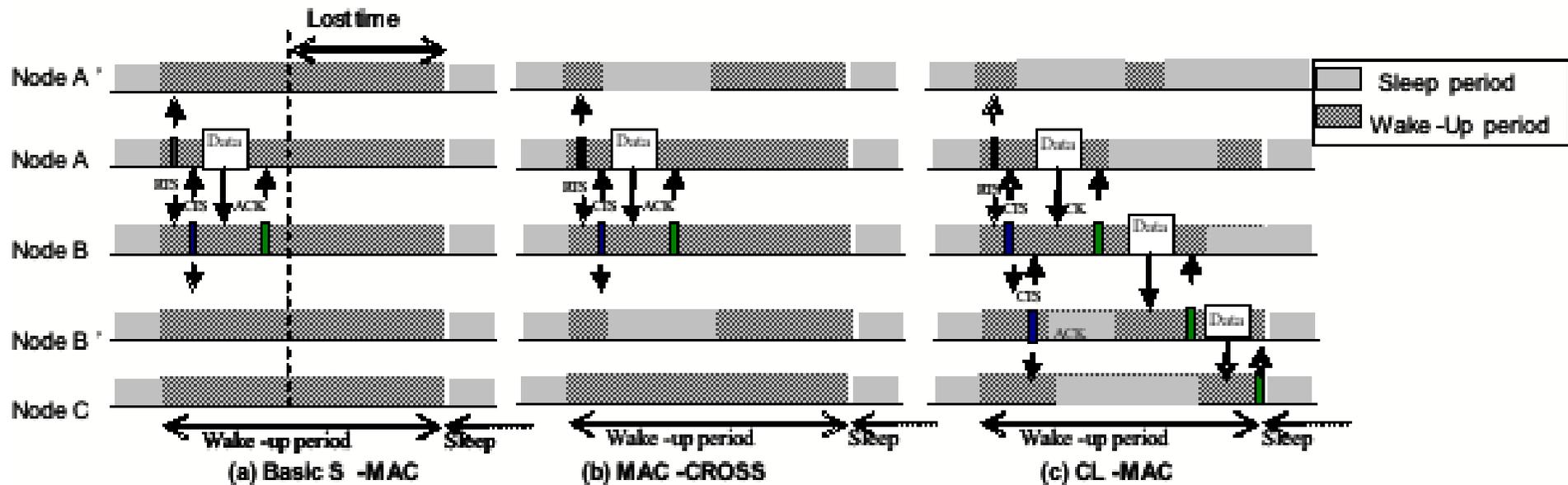
Couche CL-MAC (3)



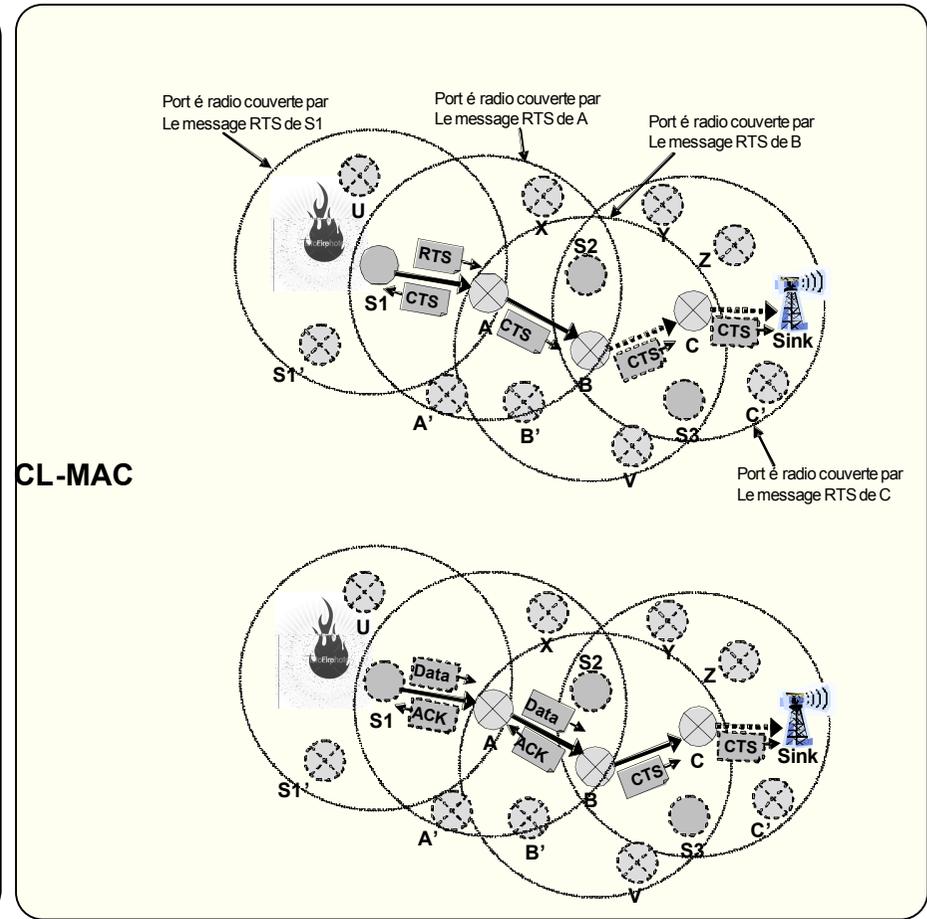
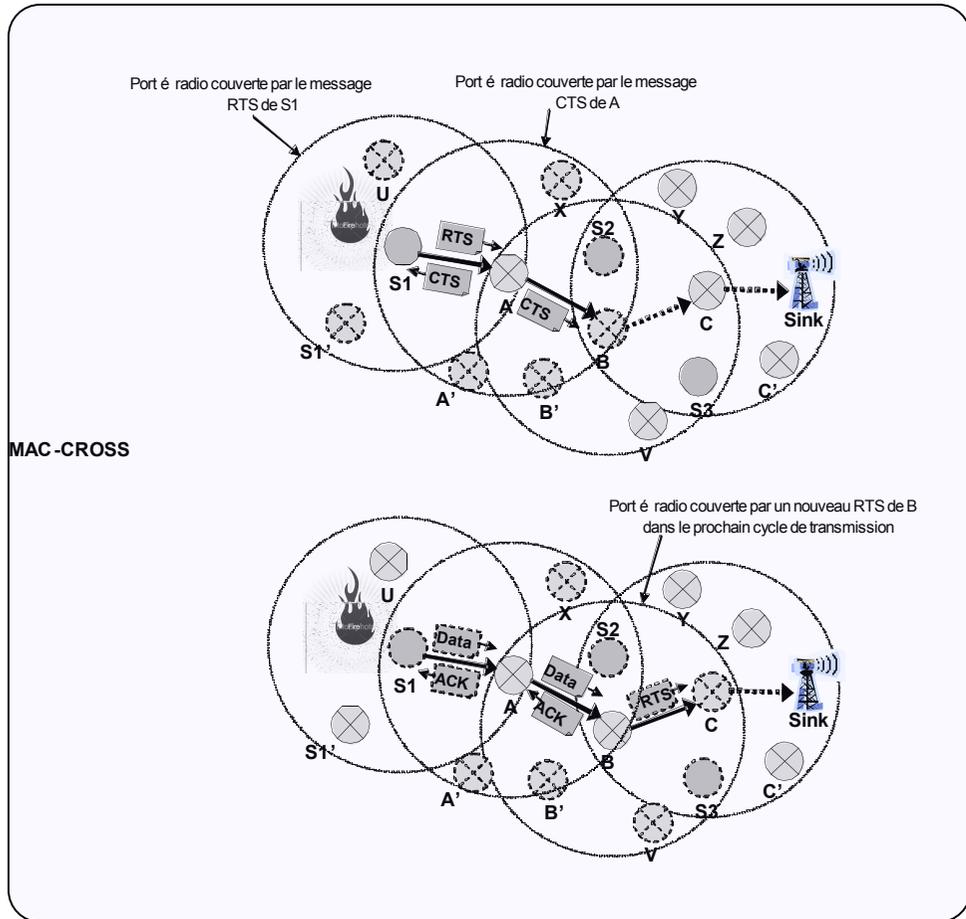
➔ Nouvelles structures

➔ Comportement de CL-MAC

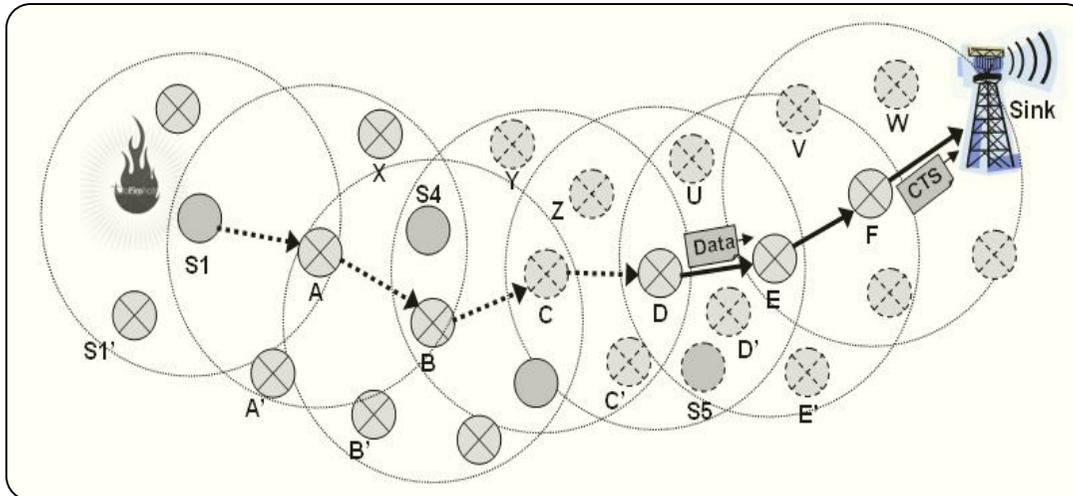
Avantage de CL-MAC (4)



Avantage de CL-MAC (5)

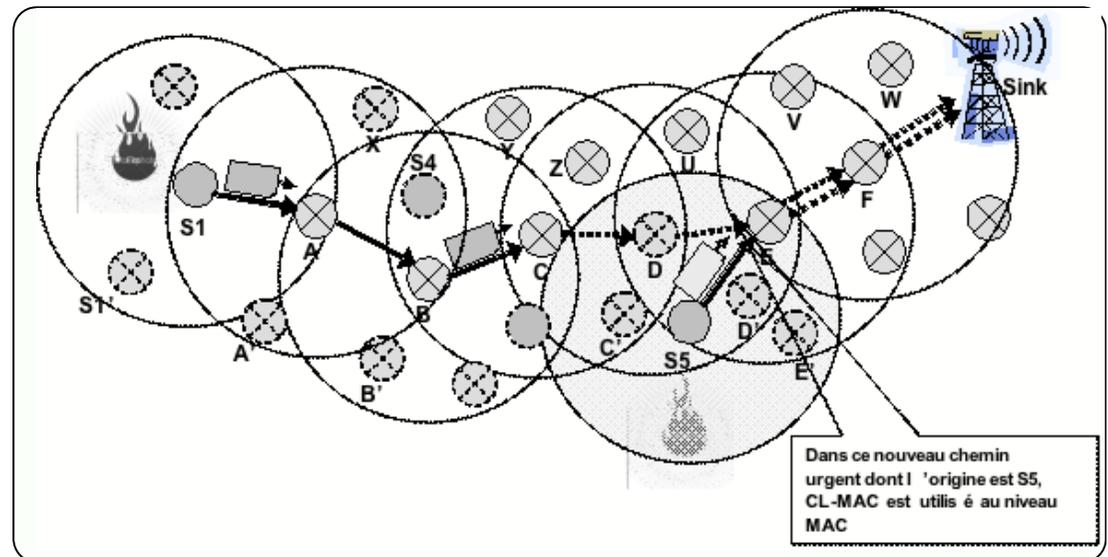


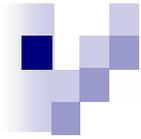
CL-MAC : Autres détails



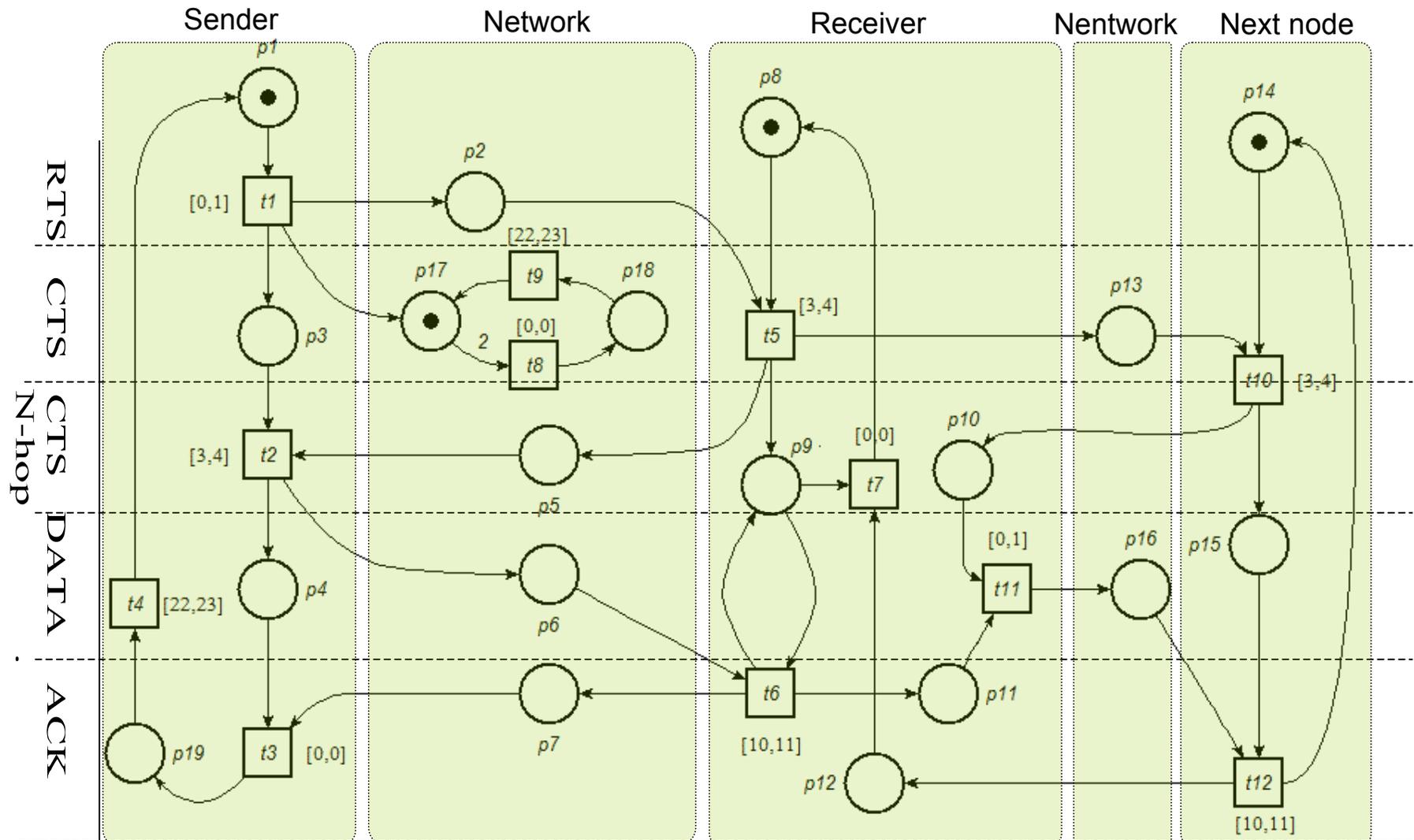
Cas de coexistence
de plusieurs chemins

Cas de libération de
chemin de routage



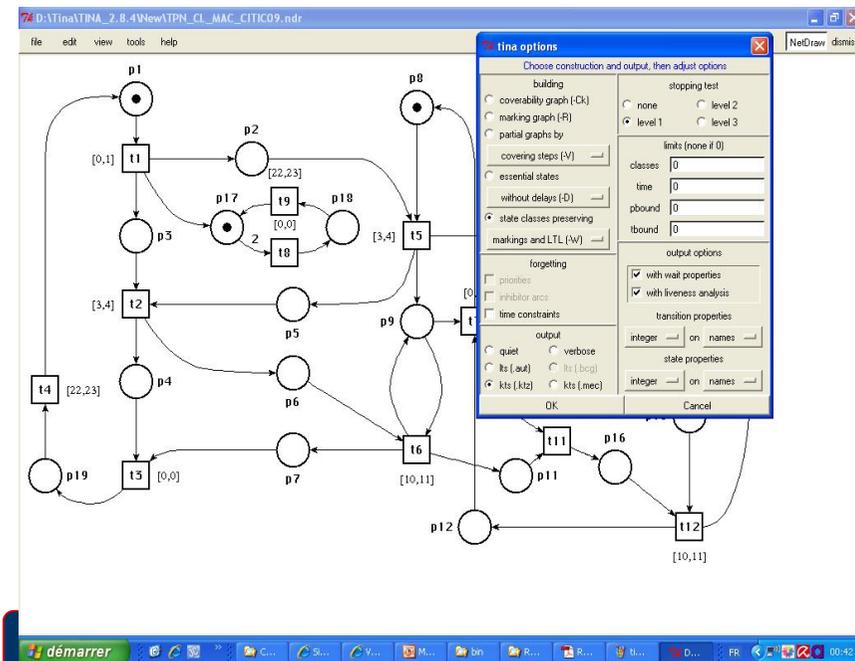
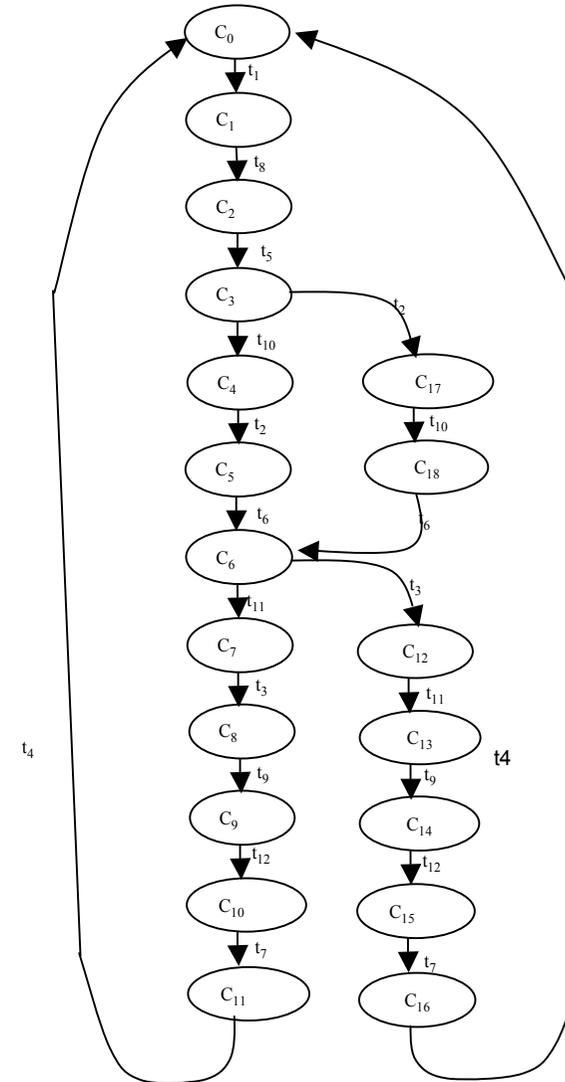
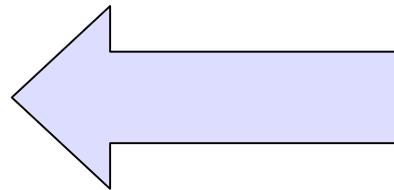


Modélisation Formelle de CL-MAC : RDP-temporel

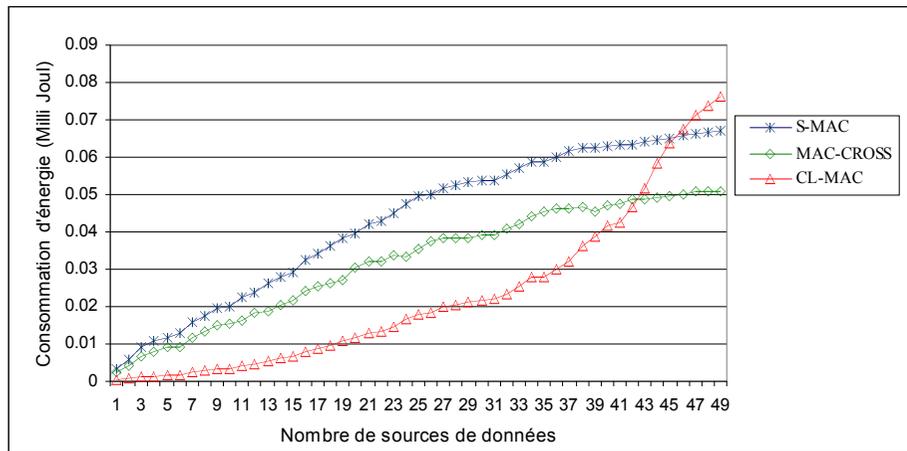


Analyse formelle de CL-MAC (Tina) → Graphe d'accessibilité

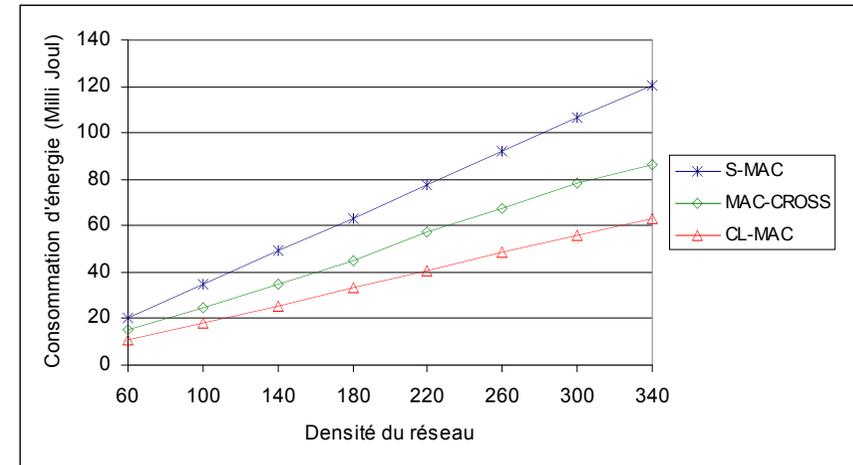
- Vivacité
- Borné
- Réversible



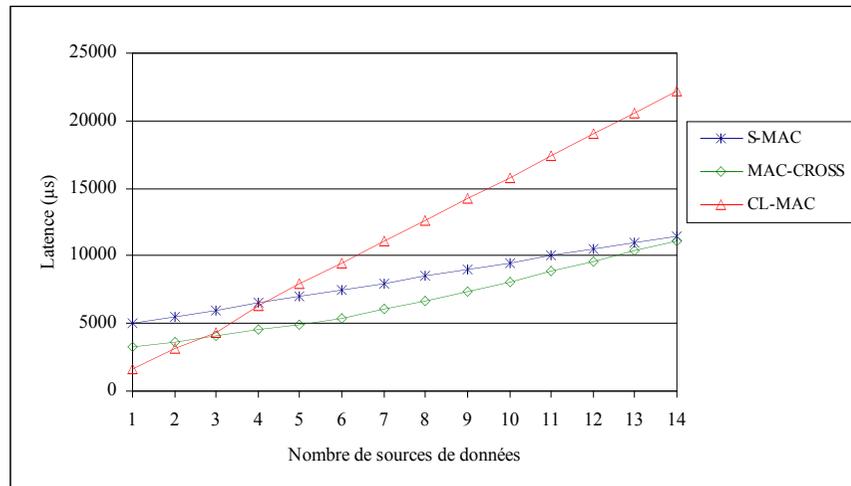
Évaluation des performances de CL-MAC



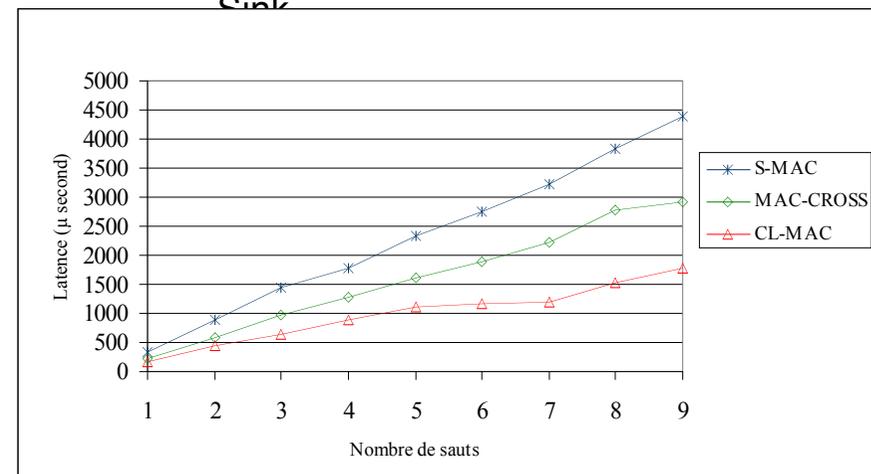
60 nœuds déployés



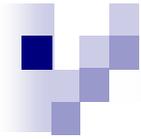
1 source à 10 sauts du Sink



150 nœuds déployés



60 nœuds déployés

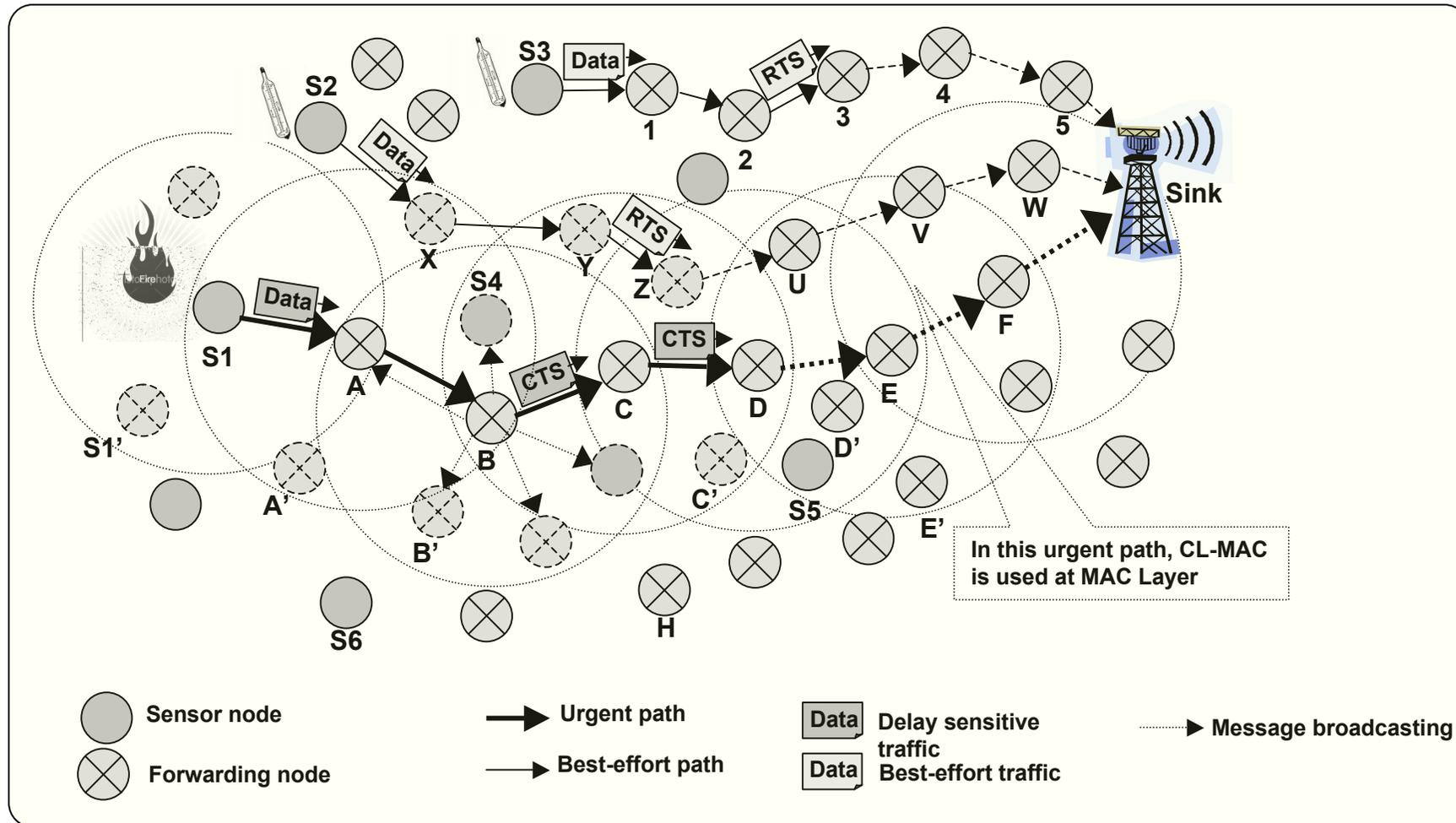


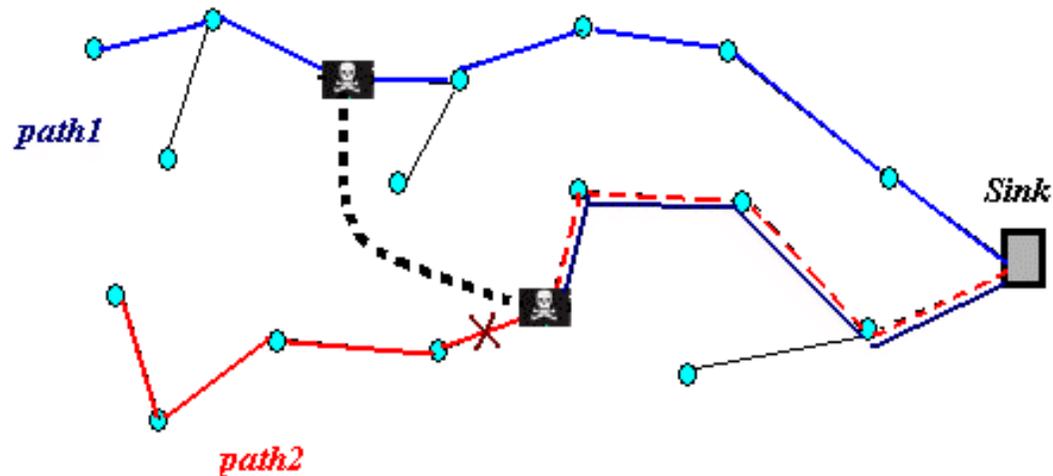
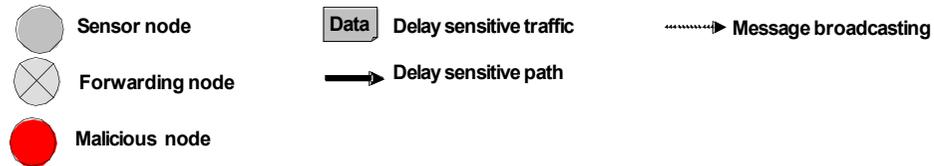
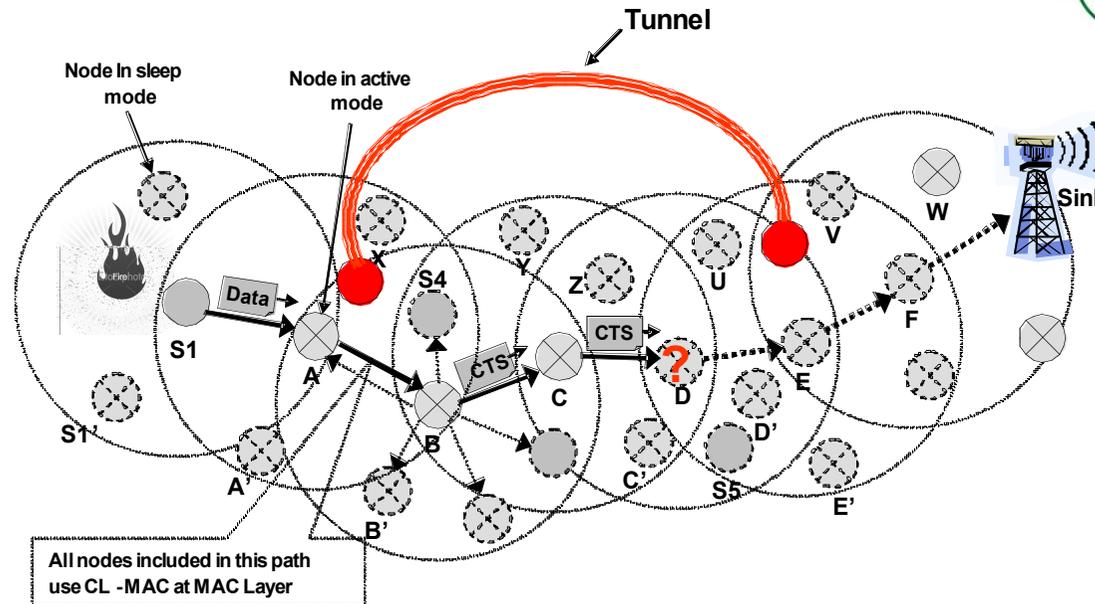
Discussion

- **Adapté pour les applications des RCSF sensibles au délai (ex: feu de forêt, surveillance vidéo, ...)**

- **Travaux en cours:**
 - Évaluation sous Omnet++/Castalia (énergie, latence) – T-MAC
 - Extension de CL-MAC → ACL-MAC (Adaptive CL-MAC)
 - Sécuriser le protocole CL-MAC

Extension: Vers ACL-MAC (CL-MAC adaptatif)



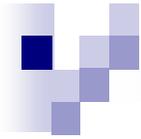


Conclusion

👉 L'approche Cross-layer (plusieurs couches:
Routage-MAC-**Physique**)

👉 Problème ?

- Validation par simulation (limite!!!)
- Validation par test-bed difficile (beaucoup de moyens)



Merci pour votre attention...

Vos Questions ...

Vos remarques ...