Routing Algorithms in NDN Networks

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Plan

Plan

CISCO & PIRL

Cisco Systems France.

PIRL

Paris **I**nnovation and and **R**esearch **L**aboratory.

Alain FIOCCO
Director CTO

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Distinguished Engineer

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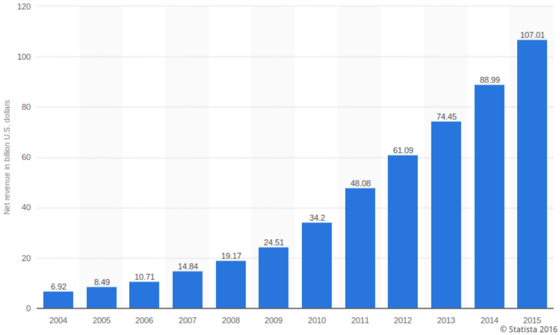
Principle Engineer

Me
Intern Student

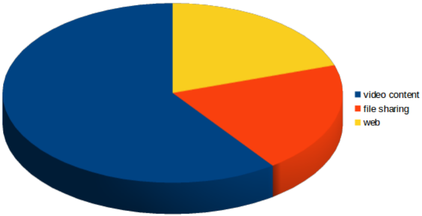
Goals and objectives

Net Revenu for Video Delivery Applications



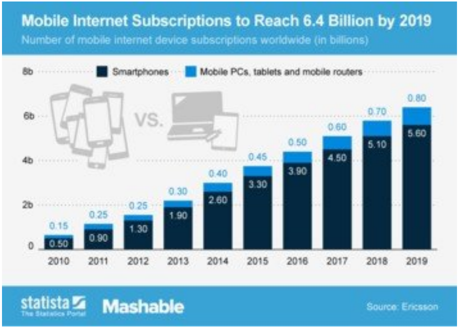
Goals and objectives

In 2016, More than 96 % of internet traffic is content.
Video $\longrightarrow$ 60%
File sharing $\longrightarrow$ 20%
Web $\longrightarrow$ 20%



Goals and objectives

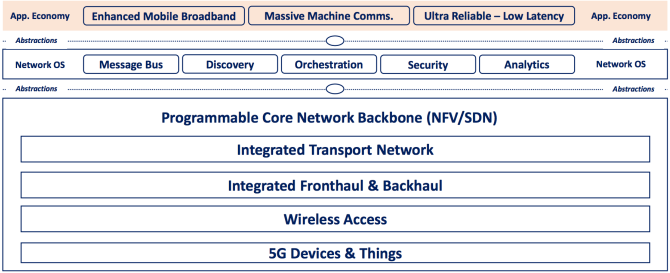
Mobile vs PC Internet Traffic user ⟶ 5G mobile networks



Plan

Named Data networking (NDN)

- V.Jacobson et al proposition, *Networking Named Content* 2009.
- **I**nformation **C**entric **N**etworking ⇒ ***Name*** base Philosophy vs IP ***Calling*** Networking.
- A Good fit network desiging for Video Delivery Applications in **5G**.



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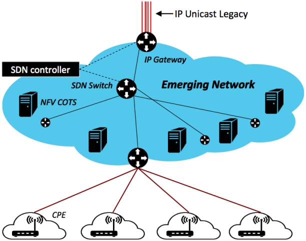
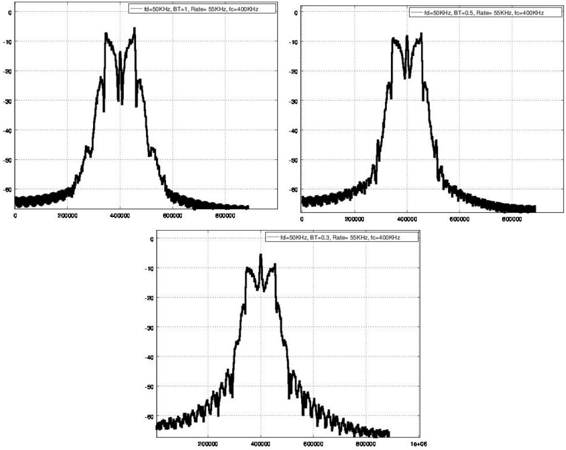


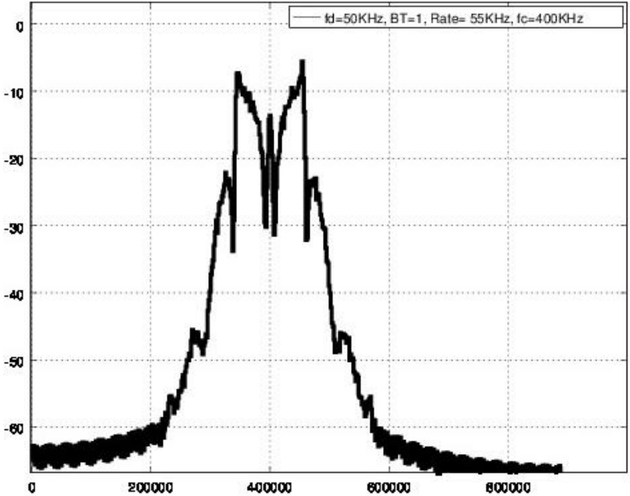
Choix du Filtre Gaussien

- GFSK modulation $\rightarrow BT$(Paramètre de filtre Gaussien) $= 1, 0.5, 0.3$
  - Bit Error Rate
  - Intérference entre canaux adjacents



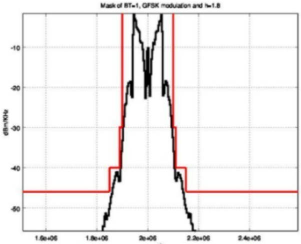
Choix du Filtre Gaussien

- GFSK modulation $\rightarrow$ BT(Paramètre de filtre Gaussien) $= \mathbf{1}$ $\rightarrow$ Normal-Rate



Design Mask

Publié la nouvelle Spécification de DASH7 (Version 1.0), En Mai 2015.



Normal-Rate, GFSK, D = 55Kbps
Bd = 100KHz, h = 1.8

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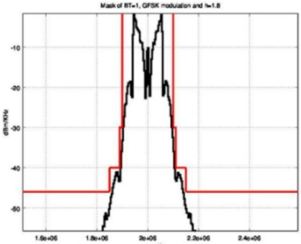

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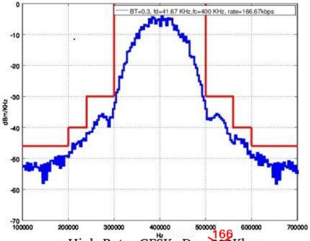

High-Rate, GFSK, D = ~~200~~ 166Kbps
Bd = 100KHz, h = 0.5

Design Mask

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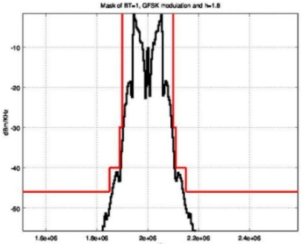

Normal-Rate, GFSK, D = 55Kbps
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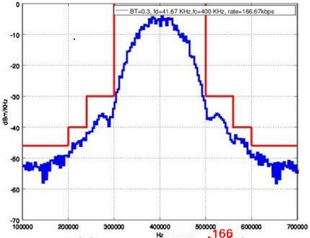

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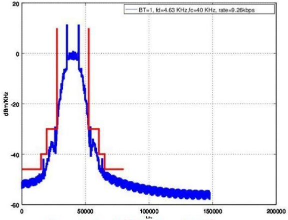
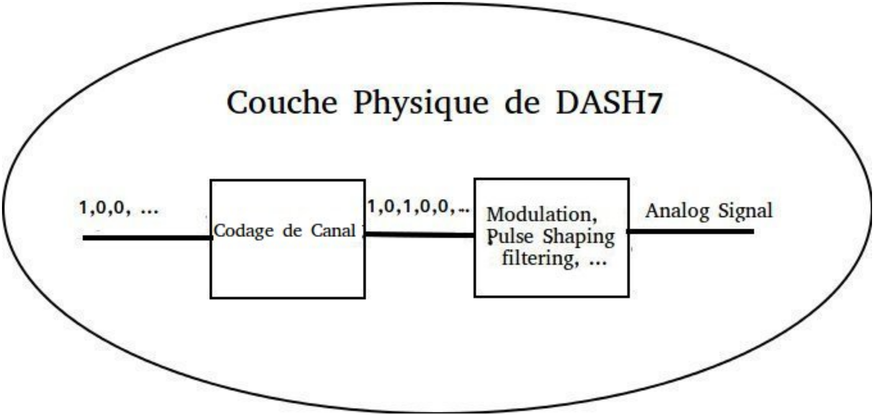


Low-Rate, GFSK, D = 9.6Kbps
Bd = 9.6KHz, h = 1

→ Cognitive Radio (SDR)


Couche Physique de DASH7
1,0,0, ...
Codage de Canal
1,0,1,0,0,..
Modulation,
Pulse Shaping
filtering, ...
Analog Signal

Codages du Canal

- Les Codes de Contrôle d'erreur

- Codage à Détecter les erreurs (CRC, CheckSum, Parité, ...).
- Codage à Détecter et Corriger les erreurs(LDPC, Convolutif,Turbo, RS, BCH, ...).

Le Concept Principal de Notre Proposition

Header + Payload + CRC (Convolutif) $\rightarrow$ Header (**RS**), Payload (**LDPC**) + CRC

- Header: RS $\rightarrow$ La longeur petite
  -RS(60,28)
  - Encodage: Structure algébrique des polynomials ($g(x)$).
  - Décodage: Error Trapping.
- Payload: LDPC $\rightarrow$ Pourquoi?

Header	Payload	CRC16
$28 Bit$	$16 - 255 Byte$	$2 Byte$

LDPC vs Convolutif dans les expériences et Handbooks ...

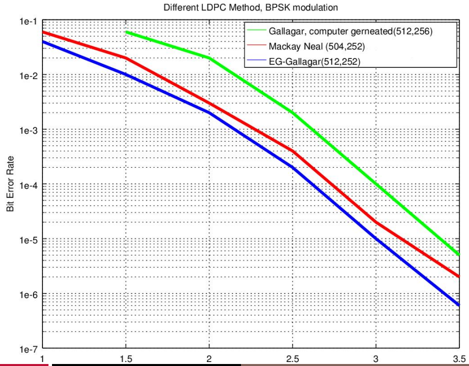
Pourquoi LDPC?

- Très proche à la limite de Shannon (0.042dB).
- Augmentation la taille de Matrice Parité Check $\rightarrow$ Meilleur Performance.
- Pour changer le taux on peut juste modifier les lignes.
- Ils ne sont pas brevetés et très répandu.
- Application Réseau: 5G, Wi-Fi, IEEE 802.16 (WiMAX), 10GBase-T de Ethernet, DVB-S2, ...

LDPC

Choix de LDPC (Méthodes Aléatoires)

- En vert: Gallagar,Computer generated, 1963 $\rightarrow$ Dégradation, *girth* $=$ *4-cycle* $\rightarrow$ Matrice de **Génératrice** (Encodage: non complèxe)
- En rouge: Mackay-Neal, 1996 [1]$\rightarrow$ Eviter les 4-cycles $\rightarrow$ Matrice **Génératrice** (Encodage: complèxe)

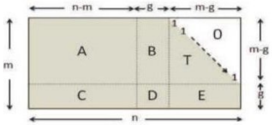


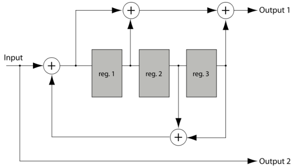
$$\mathbf{H} := \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{pmatrix}_{4,8}$$

LDPC (1/2) vs Convolutif (1/2)

LDPC Contre Convolutif (Encodage)

- **LDPC Mackay-Neal**: Complèxe $\rightarrow$ Algorithm de Richardson-Urbanke $\rightarrow$ Diréctement a travers de **H** — $O(n^2) \rightarrow O(n+g^2)$.
- **Convolutif**: Circuit de Shift Register.





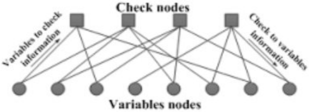
LDPC (1/2) vs Convolutif (1/2)

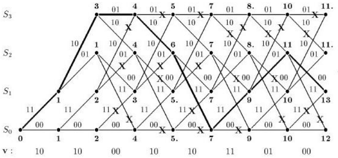
LDPC Contre Convolutif (Décodage)

LDPC:

- Hard: Algorithme de Bit flipping → Graph Tanner (iteration = 10) .
- Soft: Algorithme de Log-DomainSimple (Version simplifiée de l'algorithm SPA) → Probabilité a priori (ML) (iteration = 10)

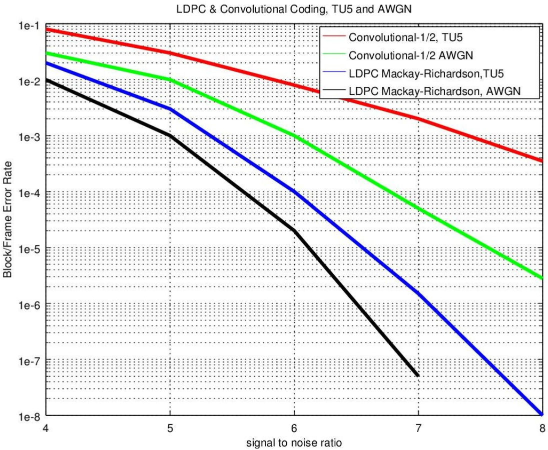
- **Convolutif**: Algorithm de Viterbi → Graph Trellis





LDPC (1/2) vs Convolutif (1/2)

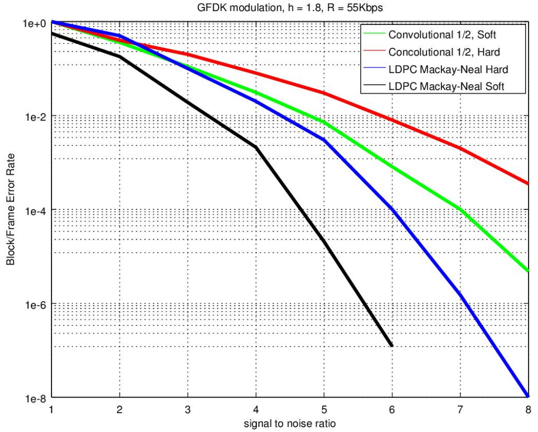
LDPC vs Convolutif



LDPC (1/2) vs Convolutif (1/2)

LDPC(1/2) vs Convolutif(1/2)

Modèle de canal: AWGN & TU5 (Typical-Urban)→ Jakes algorithm



Plan

Conclusion

- Les Travaux de recherche dovient avoir toujours à la tête les aspects et contraintes pratiques.
- La Simulation est un trés bons moyen pour avoir un preuve théorique Mathèmatique.
- Les Nouvelle Propositions des canaux et Nouveaux Codage du canal peut utiliser au sein de protocole de DASH7.
- Les Autres développements peut se faire au future comme avoir un Relay, Egaliseur, Software Defined Radio ... .


MERCI

Shu Lin, Daniel J.Costello, Jr. *Error Control Coding*. (Second Edition), 2004.