System Level Performance Evaluation on Transmission Format of USCCH in IEEE 802.16m

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Venue:

IEEE 802.16m-08/024, “Call for Comments and Contributions on Project 802.16m System Description Document (SDD)”.

Target topic: “DL Control Structure”.

Base Contribution:

None

Purpose:

To be discussed and adopted by TGm for the 802.16m SDD

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About This Contribution

- **Proposal on Text Modification**

802.16m -08/003r3	~~**The transmission format (joint/separate) for user-specific control information is FFS.**~~

Separate	For user-specific control information, multiple information elements are coded separately.

Based on System Level Performance Evaluation

This contribution gives the reason why we should adopt Separate Coding

Joint vs. Separate

Performance Metrics		Separate Coding	*Joint Coding	Note
Signaling Bit Overhead	CID	▪ Possible to eliminate CID overhead	▪ Per assignment message	▪ Separate: CRC masked by CID, scrambling using CID, etc
	CRC	▪ Per assignment message	▪ One CRC	
Coding gain (Length)		▪ Smaller	▪ Larger	
Link adaptation gain		▪ Larger	▪ Smaller	
Packing Efficiency		▪ Lower	▪ Higher	

All metrics are finally expressed as **MAP OVERHEAD**

System Level Performance Evaluation

SEPARATE CODING ***has more gain than Joint coding***
(next slide)

*Joint coding: all assignment messages are combined together and encoded

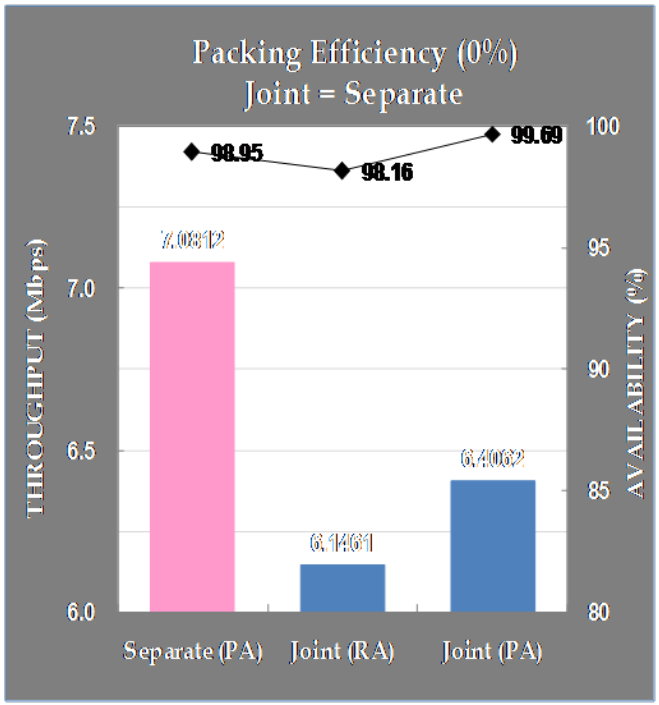
System Level Performance Evaluation

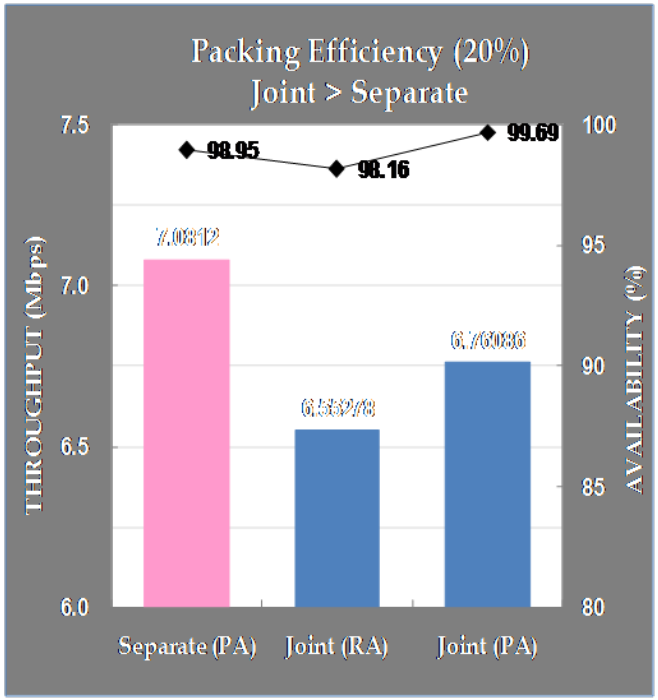
Joint vs. Separate

- **Separate >> Joint**
  - Link adaptation gain is larger than coding gain + packing efficiency

Item	Condition
Coding Gain	Reflected
Packing Efficiency	Assumption: Joint is 0% or 20% higher than Separate
Link Adaptation	Power or Rate (MCS)

- PA: Power adaptation, RA: Rate adaptation
- Availability (%) = 100 – MAP outage





Transmission Format	MAP Overhead (%)	
	PE 0 %	PE 20 %
Separate (PA)	13.4	13.4
Joint (RA)	24.9	19.9
Joint (PA)	21.7	17.3

Sub-MAP

Short period (small n)	Scheduling Interval (Every *n* sub-frames)	Long period (large n≥4)

Small number of scheduled users

↓

User grouping is difficult

↓

high indication OH + high link adaptation gain

or

low indication OH + small link adaptation gain

↓

***SEPARATE CODING* has more gain than Sub-MAP**

Separate coding ≈ Sub-MAP

?

↑

CANNOT satisfy latency requirement in SRD

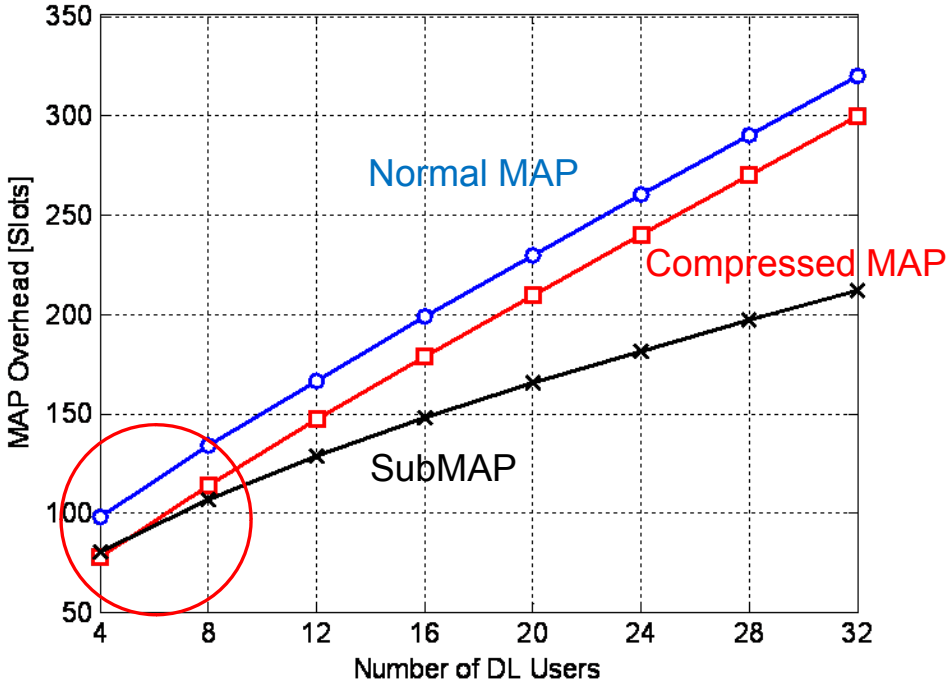
Even Joint coding can have better performance than Sub-MAP

(next slide)

Overhead Analysis

Joint vs. Sub-MAP

- **Simulation Condition**
  - Based on 16e system
  - System level user distribution + Link level performance
  - Non-HARQ burst : HARQ burst = 1 : 1, Number of users DL : UL = 1 : 1
  - Maximum 3 sub-MAP user groups



When the number of users is small, Sub-MAP yields worse or similar performance compared to joint coding

Link adaptation gain <
Indication overhead

We expect the number of scheduled MSs per a sub-frame is around 3~4

Summary

- **Criteria: Sector Throughput (Overhead)**
  - Joint coding **< Separate coding**
    - Link adaptation gain > coding gain + packing efficiency
  - Sub-MAP-style joint coding **≈** joint coding **< Separate coding**
    - When scheduling Interval is short (small *n*)
    - Small user-grouping gain in sub-MAP

SEPARATE CODING is better than Joint coding (including Sub-MAP) in respect to **SECTOR THROUGHPUT**

Annex: System Level Simulation (1)

- **Major Assumptions**
  - Subframe-based structure
    - [IEEE C802.16m-08/062r1]
  - Only assignment block in MAP region
    - 48 bits (including CRC) per assignment block
  - 2-D MAP region
  - FDM
  - Link adaptation
    - Separate: per user, Joint: based on worst user

- **Performance Metrics**
  - **Sector Throughput** with satisfying MAP outage requirement
  - **MAP Outage** requirement: Distribution of user whose BLER is larger than 1% < 3% of total users

Annex: System Level Simulation (2)

- **Simulation Environments/Assumptions**

Index	Value
Deployment Scenario	EMD baseline [IEEE 802.16m-07/037r2]
MCS for MAP	QPSK, 1/2
HARQ	Synchronous (No assignment message for retransmission)
Scheduler	Proportional fairness
# of Users per Sector	10
# of Scheduled Users	3 per sub-frame (6 for both DL and UL)
MAP Error Effects	Resource loss for MAX retransmission
Antenna Configuration	SIMO 1x2
Channel Model	Mixed (Ped B-3kmph-60%, Veh A-30kmph-30%, Veh A-120kmph-10%)
Channel Estimation	Real channel estimation (Equal impairment for both TDM and FDM)
Other Simulation Assumptions	EMD baseline