Transmission Format for Unicast Service Control Channels in IEEE 802.16m

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE C802.16m-08/507

Date Submitted:

2008-05-12

Source:

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Venue:

IEEE C80216m-08/297, “Call for Comments on DL Control Rapportuer Group Contribution ”.

Target topic: “Unicast Service Control Channels”.

Base Contribution:

None

Purpose:

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

Notice:

Release:

Patent Policy:

Transmission Format for Unicast Service Control Channels in IEEE 802.16m

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May, 2008

Transmission Format

- **4 Options**

Option 1: Jointly coded/Fixed MCS [Multiple unicast service control information elements are coded jointly to form a control block and the same MCS is used for each coded control block that is transmitted.]	***Option 2: Jointly coded/Variable MCS*** [Multiple unicast service control information elements are coded jointly to form a control block and a different MCS can be used for each coded control block that is transmitted.]
Option 3: Separately coded/Fixed MCS [Multiple unicast service control information elements are coded separately and the same MCS is used for each control information element that is transmitted.]	***Option 4: Separately coded/Variable MCS*** [Multiple unicast service control information elements are coded separately and a different MCS can be used for each control information element that is transmitted.]

Keep option 3 and Delete option 1 and option 2.
Option 4 is FFS.

⟶ **This contribution gives the reason why we should adopt separate coding**

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

Full System Level Performance Evaluation

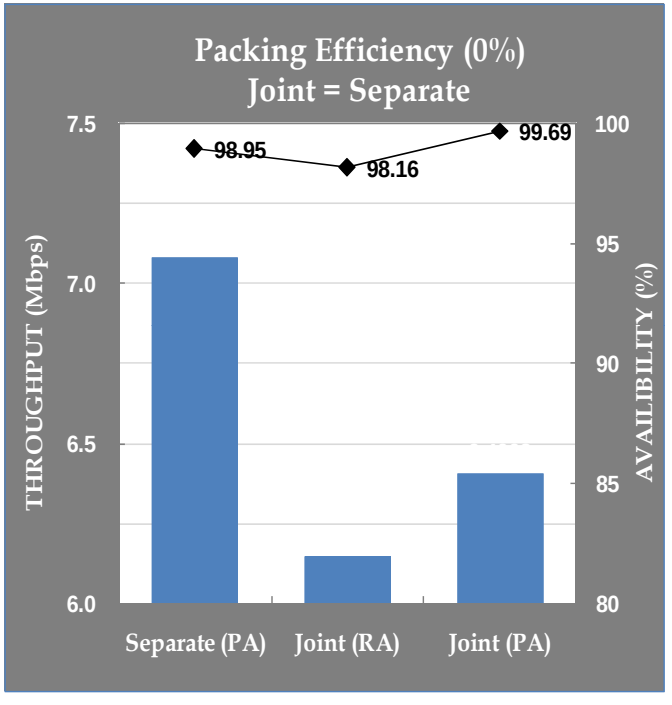
Separate coding ***has more gain than Joint coding***

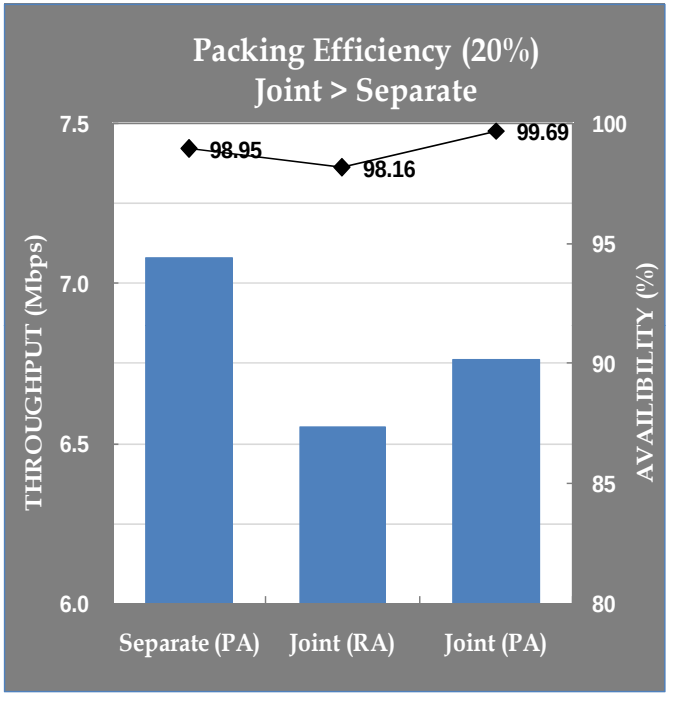
System Level Performance Evaluation

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

- MAP is transmitted every subframe
- PA: Power adaptation, RA: Rate adaptation

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





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

Separate Coding vs. Sub-MAP

Performance Metrics		Separate Coding	Sub-MAP	Joint Coding
Signaling Bit Overhead	CID	▪ Possible to eliminate CID overhead	▪ Per assignment message	▪ Per assignment message
	CRC	▪ Per assignment message	▪ Per sub-MAP	▪ One CRC
Coding gain (Length)		▪ Smaller	▪ Medium	▪ Larger
Link adaptation gain		▪ Larger	▪ Medium	▪ Smaller
Packing Efficiency		▪ Lower	▪ Medium	▪ Higher
Indication OH (header)		▪ Lower	▪ Higher	▪ Lower

Short period (small n)	**Scheduling Interval (Every *n* subframes)**	*Long period (large n)

Small number of scheduled users

↓

User grouping is difficult

↓

Separate coding style with high indication OH

or Joint coding style with low indication OH (small link adaptation gain)

↓

Separate coding ***has more gain than Sub-MAP***

Separate coding ≈ Sub-MAP

?

*Can satisfy latency requirement in SRD?

Summary

- **Metric: Sector Throughput**
  - Separate coding > Joint coding
    - Link adaptation gain > coding gain + packing efficiency
  - Separate coding > SubMAP-style joint coding
    - When scheduling Interval is short (small *n*)
    - Small user grouping gain in SubMAP
  - Long scheduling interval (large *n*)
    - Data Latency problem

- **Separate coding is better than Joint coding with 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 subframe (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