

Summary of results of the first JCT-VC meeting (Dresden, 15-23 April 2010)

The first meeting of the Joint Collaborative Team on Video Coding (JCT-VC) between ITU-T WP 3/16 and ISO/IEC JTC1 SC29 WG11 was held in Dresden, Germany, 15-23 April 2010, under the auspices of ISO/IEC JTC1 SC29 WG11 and collocated with a Q6/16 meeting.

A total of 188 persons recorded their attendance on a sign-in sheet circulated during the meeting. A total of 40 submitted input contributions were reviewed.

The documents of the meeting are listed in Annex A of this summary report, and can be found on the JCT-VC site in the following directory:

http://ftp3.itu.int/av-arch/jctvc-site/2010_04_A_Dresden

The informal name for the new standardization project is now "High Efficiency Video Coding" (HEVC).

The Joint Call for Proposals (CfP) on Video Compression Technology, which was issued by ISO/IEC MPEG and ITU-T VCEG in January 2010, had a very successful outcome. Twenty-seven complete proposal submissions were received, and the associated video material was evaluated in extensive subjective tests that were conducted prior to the first meeting of the Joint Collaborative Team on Video Coding (JCT-VC). That meeting was held under MPEG auspices in Dresden during 15-23 April 2010. The contribution documents for those proposals are at the above link with contribution numbers JCTVC-A101 to JCTVC-A127.

The test results clearly indicated that some proposals exhibited a substantial improvement in compression performance as compared to the corresponding AVC anchors - and, in a number of cases, the performance of the best proposals can be roughly characterized as achieving similar quality when using only half of the bit rate.

All proposals basically used a coding architecture that was conceptually similar to AVC (and prior video coding standards), containing the following basic elements:

- Block-based
- Variable block sizes
- Block motion compensation
- Fractional-pel motion vectors
- Spatial intra prediction
- Spatial transform of residual difference
- Integer-based transform designs
- Arithmetic or VLC-based entropy coding
- In-loop filtering to form final decoded picture

However, there was a large variety of differences at the individual coding tool level.

The technical evaluation of the proposals was performed by the JCT-VC. In addition to reviewing the subjective test results, the group studied the design features of the proposals. The meeting produced three documents that surveyed those various aspects, as follows:

- JCTVC-A201 contains decoder speed measurements for some of the proposals. (This was for a self-selected group of proposals, and some of the other proposals have slower decoders.)
- JCTVC-A202 contains an architectural outline of the proposed design elements
- JCTVC-A203 contains a table of the design elements of the proposals.

- JCTVC-A204 will be the report of the subjective testing. There will be an editing period before that is released (release target date 14 May 2010).

The first day of the meeting (Thursday April 15) was devoted to proponent cross-checking of bit rates and proper decoding operation for the submitted bitstreams. The group encountered some minor issues during that process (such as crashed hard drives, checking the wrong version of some bitstreams, platform dependencies, and not having time to check all of the data that the group might have wanted to), but ultimately the group decoded a sampling of bitstreams for every proposal, and did not find any significant problems with any proposal materials that had been submitted.

After reviewing the proposals and test results, the group tried to determine how best to transition from the "competitive phase" of individual proposal development to the "collaborative phase" of working together on a single design. It was not entirely clear how to do that, and the group discussed a number of possible paths forward. Some of the proponents got together and submitted a contribution JCTVC-A033 during the meeting, which proposed a test model reference design.

Further discussing the proposed coding tools, the group produced a consensus-supported "Test Model under Consideration" (TMuC) document. Although it is not a formally-adopted complete test model, it is a coherent collection of features that appear promising from among those of the various proposals. The coding tools in the TMuC should be further tested to confirm their effectiveness when used together in a unified coding architecture, but creating the TMuC should be a good step forward.

JCTVC-A205 contains the TMuC description. It may be somewhat further refined (in *ad hoc* activity described below), but a good draft was available by the end of the meeting.

The TMuC is intended to provide both of the following:

- a coding efficiency operating capability that is close to that of the best performing proposals in the subjective test of the CfP submissions, and also
- a complexity operating capability that is close to that of the lowest complexity submissions (while simultaneously providing a substantial improvement of coding efficiency).

The inclusion of a technology in the TMuC document does not indicate a final adoption of the technology as an element of an approved test model or draft standard of the JCT-VC committee. Rather, it indicates a preliminary selection which may require further evaluation and justification to achieve that status.

The TMuC includes design elements found in the following proposals (listed in document number order):

- JCTVC-A114 (from France Telecom, NTT, NTT DOCOMO, Panasonic and Technicolor)
- JCTVC-A116 (from HHI)
- JCTVC-A119 ("TENTM" from Tandberg, Ericsson, and Nokia)
- JCTVC-A120 (from RIM)
- JCTVC-A121 (from Qualcomm)
- JCTVC-A124 (from Samsung, with BBC)
- JCTVC-A125 (from BBC, with Samsung)

Some of those design elements are probably also found in some other proposals as well, as there was substantial similarity among many proposals.

The group also launched an effort to develop software for the TMuC design and to perform technical evaluation its capabilities. That effort will be coordinated by F. Bossen (bossen@docomolabs-usa.com) [chair], assisted by P. Chen, D. Flynn, H. Schwarz, and K. Ugur [vice chairs].

In addition to drafting the TMuC, the group established four "Tool Experiments" (TEs) to evaluate specific proposed coding tools and a number of "Ad Hoc Groups" to work on more general subject areas. (The group thought it best not to refer to the TEs as "Core Experiments", since they are not yet being conducted relative to an adopted "Test Model".)

Four "Tool Experiments" were planned, as follows:

- JCTVC-A301 on Decoder-side MV derivation, coordinated by Mathias Wien of RWTH Aachen University (wien@ient.rwth-aachen.de) and Yi-Jen Chiu of Intel (yi-jen.chiu@intel.com).
- JCTVC-A302 on Internal Bit-Depth Increase (IBDI) and Memory Compression, coordinated by Takeshi Chujoh of Toshiba (takeshi.chujoh@toshiba.co.jp).
- JCTVC-A303 on Inter prediction (focused on adaptive warped reference prediction, adaptive global motion temporal prediction, and geometric block partitioning) global & warped motion, non-rectangular partitioning), coordinated by Andreas Krutz of Tech. Univ. Berlin (krutz@nue.tu-berlin.de).
- JCTVC-A304 on variable-length coding, coordinated by Xianglin Wang of Qualcomm (xianglin@qualcomm.com).

A preliminary draft of the plan for each Tool Experiment was approved at the meeting, and is now available on the site.

Members of the JCT-VC who are interested in participating in the TEs must contact the TE coordinators within two weeks after the end of the meeting. The details of the TE experiment descriptions will also be finalized during that two week period.

TE participants must commit to providing a report of the outcome of their experiment participation as an input contribution at the next meeting.

The ad hoc groups established at the meeting were as follows:

- JCT-VC project management, coordinated by G. J. Sullivan (garysull@microsoft.com) and J.-R. Ohm (ohm@ient.rwth-aachen.de) [co-chairs].
- Test Model under Consideration (TMuC) editing, coordinated by K. McCann (ken@zetacast.com) [chair], with M. Karczewicz, J. Ridge, S. Sekiguchi, and T. Wiegand [vice chairs].
- Software development and TMuC software technical evaluation, coordinated by F. Bossen (bossen@docomolabs-usa.com) [chair], with P. Chen, D. Flynn, H. Schwarz, and K. Ugur [vice chairs].
- Intra prediction, coordinated by C. Auyeung (cheung.ayueung@am.sony.com) [chair], with S. Lei, K. Sugimoto, and H. Yu [vice chairs].
- Alternative transforms, coordinated by R. Cohen (cohen@merl.com) and R. Joshi (rajanj@qualcomm.com) [co-chairs].
- MV precision, coordinated by B. Jeon (bjeon2000@gmail.com) [chair], with X. Wang, S. Wittmann, and T. Suzuki [vice chairs].

- In-loop filtering, coordinated by T. Yamakage (tomoo.yamakage@toshiba.co.jp) [chair], with Y. J. Chiu, M. Narroschke, and X. Wang [vice chairs].
- Large block structure, coordinated by, K. Panusopone (krit@motorola.com) [chair], with M. Budagavi, and D. He [vice chairs].
- Parallel entropy coding, coordinated by M. Budagavi (madhukar@ti.com) and A. Segall (asegall@sharplabs.com) [co-chairs].

Given the level of contributions and participation and the positive spirit of the discussions, we can predict that this meeting of the JCT-VC has been only the first of a successful series of meetings for the new collaborative work between ITU-T and ISO/IEC JTC 1 on video coding.

Future work

The next JCT-VC meeting will be held during 21-28 July in Geneva Switzerland, under the auspices of ITU-T WP3/16.

The reflector to be used for discussions of all of the listed ad hoc groups is the JCT-VC reflector: jct-vc@lists.rwth-aachen.de. For subscription to this list, see <http://mailman.rwth-aachen.de/mailman/listinfo/jct-vc>.

Annex A
Documents of the first meeting of the Joint Collaborative Team on Video Coding (JCT-VC)
(Dresden, Germany, 15-23 April 2010)

General Input Document	Category	Authors	Subject	Files
JCTVC-A020	proposal (2)	X. Li (Santa Clara Univ.) L. Liu (Huawei) N. Ling (Santa Clara Univ.) J. Zheng (Hisilicon) P. Zhang (Hisilicon)	Predictive adaptive transform coefficient scan ordering for inter-frame coding	archive document (r1)
JCTVC-A021	proposal (2)	J. Park (LG) S. Park (LG) B. Jeon (LG)	Coding tools using parametric representations to improve coding efficiency	archive document (r1) presentation (r2)
JCTVC-A022	proposal (2)	L. Liu (Huawei)	Multiple predictor sets intra coding	archive document presentation
JCTVC-A023	information	S. Sakaida (NHK) Y. Shishikui (NHK) A. Ichigaya (NHK) Y. Matsuo (NHK) K. Iguchi (NHK) T. Toyoda (NHK)	7680 × 4320 format test sequences for JCT-VC	archive document
JCTVC-A024	withdrawn		(Registration withdrawn – no document provided)	withdrawn
JCTVC-A025	proposal (2)	C. Lai (Hisilicon / Huawei) Y. Lin (Hisilicon / Huawei)	New intra prediction using the correlation between pixels and lines	archive document presentation
JCTVC-A026	proposal (2)	D. Alfonso (STMicro)	Proposals for video coding complexity assessment	archive document presentation

General Input Document	Category	Authors	Subject	Files
JCTVC-A027	proposal (2)	H. Zhu (Zhu)	Arithmetic coding based on probability aggregation and delayed subdivision	archive document
JCTVC-A028	proposal (2)	J. Zheng (Hisilicon / Huawei)	Adaptive frequency weighting quantization	archive document presentation (r1)
JCTVC-A029	proposal (2) late	X. Zheng (Hisilicon) H. Yu (Huawei)	Flexible macroblock partition for inter-frame coding	archive document (r1) presentation
JCTVC-A030	proposal (2)	A. Tabatabai (Sony) T. Suzuki (Sony)	AVC based intra prediction for improved visual quality	archive document (r1) presentation
JCTVC-A031	information (2)	S. Pateux (Orange - FT)	Tools for proposal evaluations	archive document (r1)
JCTVC-A032	proposal (2)	D. Marpe (Fraunhofer HHI) H. Schwarz (Fraunhofer HHI) T. Wiegand (Fraunhofer HHI)	Novel entropy coding concept	archive document presentation (r1)

General Input Document	Category	Authors	Subject	Files
JCTVC-A033	proposal (to be clarified) late	T. Davies (BBC) K. R. Andersson (Ericsson) R. Sjöberg (Ericsson) T. Wiegand (Fraunhofer HHI) D. Marpe (Fraunhofer HHI), K. Ugur (Nokia) J. Ridge (Nokia) M. Karczewicz (Qualcomm) P. Chen (Qualcomm) G. Martin-Cocher (RIM) K. McCann (Zetacast / Samsung) W.-J. Han (Samsung) G. Bjøntegaard (Tandberg) A. Fuldseth (Tandberg)	Suggestion for a Test Model	archive document

CfP Response Input Document	Category	Authors	Subject	Files
JCTVC-A101	CfP response proposal (2)	M. Budagavi (TI) V. Sze (MIT) M. U. Demircin (TI) S. Dikbas (TI) M. Zhou (TI) A. P. Chandrakasan (MIT)	Video coding technology proposal by Texas Instruments (and MIT)	archive document presentation
JCTVC-A102	CfP response proposal (2)	K. Nakamura (Hitachi) S. Saito (Hitachi) T. Murakami (Hitachi) Y. Komatsu (Hitachi) T. Yokoyama (Hitachi)	Video coding technology proposal by Hitachi	archive document presentation

CfP Response Input Document	Category	Authors	Subject	Files
JCTVC-A103	CfP response proposal (2)	T. Suzuki (Sony) A. Tabatabai (Sony)	Video coding technology proposal by Sony	archive document (r1) presentation
JCTVC-A104	CfP response proposal (2)	K. Chono (NEC) K. Senzaki (NEC) H. Aoki (NEC) J. Tajime (NEC) Y. Senda (NEC)	Video coding technology proposal by NEC	archive document (r1) presentation
JCTVC-A105	CfP response proposal (2)	A. Segall (Sharp) T. Yamamoto (Sharp) J. Zhao (Sharp) Y. Kitaura (Sharp) Y. Yasugi (Sharp) T. Ikai (Sharp)	Video coding technology proposal by Sharp	archive document (r1) presentation
JCTVC-A106	CfP response proposal (2)	Y.-J. Chiu (Intel) L. Xu (Intel) W. Zhang (Intel) H. Jiang (Intel)	Video coding technology proposal by Intel	archive document presentation
JCTVC-A107	CfP response proposal (2)	K. Sugimoto (Mitsubishi Electric) Y. Itani (Mitsubishi Electric) Y. Isu (Mitsubishi Electric) N. Hiwasa (Mitsubishi Electric) S. Sekiguchi (Mitsubishi Electric) R. A. Cohen (MERL) P. Wu (Mitsubishi Electric R&D Europe) N. Sprljan	Video coding technology proposal by Mitsubishi Electric	archive document presentation

CfP Response Input Document	Category	Authors	Subject	Files
		(Mitsubishi Electric R&D Europe)		
JCTVC-A108	CfP response proposal (2)	S. Sakazume (JVC Kenwood) M. Ueda (JVC Kenwood) S. Fukushima (JVC Kenwood) H. Namamura (JVC Kenwood) K. Arakage (JVC Kenwood) T. Kumakura (JVC Kenwood)	Video coding technology proposal by JVC	archive document (r1) presentation
JCTVC-A109	CfP response proposal (2)	Y.-W. Huang (Mediatek) C.-M. Fu (Mediatek) Y.-P. Tsai (Mediatek) J.-L. Lin (Mediatek) Y. Chang (Mediatek) J.-H. Guo (Mediatek) C.-Y. Chen (Mediatek) S. Lei (Mediatek) X. Guo (Mediatek) Y. Gao (Mediatek) K. Zhang (Mediatek) J. An (Mediatek)	Video coding technology proposal by Mediatek	archive document (r2) presentation
JCTVC-A110	CfP response proposal (2)	B. Jeon (LG) S. Park (LG) J. Kim (LG) J. Park (LG)	Video coding technology proposal by LG Electronics	archive document (r1) presentation
JCTVC-A111	CfP response proposal (2)	H. Yang (Huawei) J. Fu (Huawei) S. Lin (Huawei) J. Song (Huawei) D. Wang (Huawei)	Video coding technology proposal by Huawei Technologies and Hisilicon Technologies	archive document (r1) presentation

CfP Response Input Document	Category	Authors	Subject	Files
		M. Yang (Huawei) J. Zhou (Huawei) H. Yu (Huawei), C. Lai (Hisilicon) Y. Lin (Hisilicon) L. Liu (Hisilicon) J. Zheng (Hisilicon) X. Zheng (Hisilicon)		
JCTVC-A112	CfP response proposal (2)	S. Kamp (RWTH Aachen Univ.) M. Wien (RWTH Aachen Univ.)	Video coding technology proposal by RWTH Aachen University	archive document presentation
JCTVC-A113	CfP response proposal (2)	J. Lim (SK telecom) J. Song (SK telecom) H. Park (Sejong Univ.) C.-W. Seo (Sejong Univ.) D.-Y. Kim (Sejong Univ.) J. O. Lee (Sejong Univ.) M.-J. Kim (Sejong Univ.) S.-W. Hong (Sejong Univ.) M.-H. Jang (Sejong Univ.) H. K. Kim (Sejong Univ.) Y.-L. Lee (Sejong Univ.) J.-K. Han (Sejong Univ.) B. Jeon (Sungkyunkwan Univ.) J.-H. Moon (Sejong Univ.)	Video coding technology proposal by SK telecom, Sejong University and Sungkyunkwan University	archive document presentation
JCTVC-A114	CfP response proposal (2)	I. Amonou (FT) N. Cammas (FT) G. Clare (FT) J. Jung (FT)	Video coding technology proposal by France Telecom, NTT, NTT DoCoMo, Panasonic and Technicolor	archive document annex A annex B

CfP Response Input Document	Category	Authors	Subject	Files
		L. Noblet (FT) S. Pateux (FT) S. Matsuo (NTT) S. Takamura (NTT) C. S. Boon (NTT DoCoMo) F. Bossen (NTT DoCoMo) A. Fujibayashi (NTT DoCoMo) S. Kanumuri (NTT DoCoMo) Y. Suzuki (NTT DoCoMo) J. Takiue (NTT DoCoMo) T. K. Tan (NTT DoCoMo) V. Drugeon (Panasonic) C. S. Lim (Panasonic) M. Narroschke (Panasonic) T. Nishi (Panasonic) H. Sasai (Panasonic) Y. Shibahara (Panasonic) K. Uchibayashi (Panasonic) T. Wedi (Panasonic) S. Wittmann (Panasonic) P. Bordes (Technicolor) C. Gomila (Technicolor) P. Guillotel (Technicolor) L. Guo (Technicolor) E. François (Technicolor) X. Lu (Technicolor) J. Sole (Technicolor) J. Vieron (Technicolor) Q. Xu (Technicolor) P. Yin (Technicolor) Y. Zheng (Technicolor)		annex C appendix 1 presentation

CfP Response Input Document	Category	Authors	Subject	Files
JCTVC-A115	CfP response proposal (2)	K. Kazui (Fujitsu) J. Koyama (Fujitsu) A. Nakagawa (Fujitsu)	Video coding technology proposal by Fujitsu	archive document presentation
JCTVC-A116	CfP response proposal (2)	M. Winken (Fraunhofer HHI) S. Boße (Fraunhofer HHI) B. Bross (Fraunhofer HHI) P. Helle (Fraunhofer HHI) T. Hinz (Fraunhofer HHI) H. Kirchhoffer (Fraunhofer HHI) H. Lakshman (Fraunhofer HHI) D. Marpe (Fraunhofer HHI) S. Oudin (Fraunhofer HHI) M. Preiß (Fraunhofer HHI) H. Schwarz (Fraunhofer HHI) M. Siekmann (Fraunhofer HHI) K. Sühring (Fraunhofer HHI) T. Wiegand (Fraunhofer HHI)	Video coding technology proposal by Fraunhofer HHI	archive document presentation
JCTVC-A117	CfP response proposal (2)	T. Chujoh (Toshiba) A. Tanizawa (Toshiba) T. Yamakage (Toshiba)	Video coding technology proposal by Toshiba	archive document (r1) presentation (r1)
JCTVC-A118	CfP response proposal (2)	F. Wu (Microsoft Research Asia) X. Sun (Microsoft Research Asia) J. Xu (Microsoft Research Asia) Y. Zhou (Microsoft Research Asia)	Video coding technology proposal by Microsoft (and the University of Science and Technology of China)	archive document presentation

CfP Response Input Document	Category	Authors	Subject	Files
		Asia) W. Ding (Univ. Sci. Tech. China) X. Peng (Univ. Sci. Tech. China) Z. Xiong (Univ. Sci. Tech. China)		
JCTVC-A119	CfP response proposal (2)	K. Ugur (Nokia) K. R. Andersson (LM Ericsson) A. Fuldseth (Tandberg Telecom)	Video coding technology proposal by Tandberg, Nokia, and Ericsson	archive document appendix presentation
JCTVC-A120	CfP response proposal (2)	D. He (RIM) G. Korodi (RIM) G. Martin-Cocher (RIM) E.-h. Yang (RIM) X. Yu (RIM) J. Zan (RIM)	Video coding technology proposal by Research in Motion	archive document presentation (r1)
JCTVC-A121	CfP response proposal (2)	M. Karczewicz (Qualcomm) P. Chen (Qualcomm) R. Joshi (Qualcomm) X. Wang (Qualcomm) W.-J. Chien (Qualcomm) R. Panchal (Qualcomm)	Video coding technology proposal by Qualcomm	archive document presentation
JCTVC-A122	CfP response proposal (2)	A. Ichigaya (NHK) K. Iguchi (NHK) Y. Shishikui (NHK) S. Sekiguchi (Mitsubishi Electric) K. Sugimoto (Mitsubishi Electric)	Video coding technology proposal by NHK and Mitsubishi	archive document presentation

CfP Response Input Document	Category	Authors	Subject	Files
		A. Minezawa (Mitsubishi Electric)		
JCTVC-A123	CfP response proposal (2)	Y.-W. Chen (NCTU) T.-W. Wang (NCTU) C.-H. Chan (NCTU) C.-L. Lee (NCTU) C.-H. Wu (NCTU) Y.-C. Tseng (NCTU) W.-H. Peng (NCTU) C.-J. Tsai (NCTU) H.-M. Hang (NCTU)	Video coding technology proposal by National Chiao Tung University (NCTU)	archive document (r1) presentation (r1)
JCTVC-A124	CfP response proposal (2)	K. McCann (Zetacast / Samsung) W.-J. Han (Samsung) I.-K. Kim (Samsung)	Video coding technology proposal by Samsung (and BBC)	archive document (r1) presentation
JCTVC-A125	CfP response proposal (2)	T. Davies (BBC)	Video coding technology proposal by BBC (and Samsung)	archive document (r1) presentation
JCTVC-A126	CfP response proposal (2)	S. Mochizuki (Renesas) K. Iwata (Renesas)	Video coding technology proposal by Renesas	archive document (r1) presentation (r1)
JCTVC-A127	CfP response proposal (2)	H. Y. Kim (ETRI) S. Jeong (ETRI) S.-C. Lim (ETRI) J. Kim (ETRI) H. Lee (ETRI) J. Lee (ETRI) S. Cho (ETRI) J. S. Choi (ETRI)	Video coding technology proposal by the Electronics and Telecommunications Research Institute (ETRI)	archive document (r2) presentation (r2)

CfP Response Input Document	Category	Authors	Subject	Files
		J. W. Kim (ETRI)		

Output Report Document	Category	Authors	Subject	Files
JCTVC-A200	meeting report (to appear)	G. J. Sullivan (Microsoft) J.-R. Ohm (RWTH Aachen Univ.)	Meeting report of the first meeting of the Joint Collaborative Team on Video Coding (JCT-VC), Dresden, DE, 15-23 April, 2010	archive
JCTVC-A201	break-out report	K. Sühring (Fraunhofer HHI)	Results of break-out work on decoder speed measurement	archive document
JCTVC-A202	output study document	JCT-VC	Architectural outline of proposed High Efficiency Video Coding (HEVC) design elements	archive document
JCTVC-A203	output study document	JCT-VC	Table of proposal design elements for High Efficiency Video Coding (HEVC)	archive document
JCTVC-A204	subjective test report (to appear)	JCT-VC	Report of subjective testing of responses to Joint Call for Proposals (CfP) on video coding technology for High Efficiency Video Coding (HEVC)	archive
JCTVC-A205	output study document	JCT-VC	Test Model under Consideration (TMuC)	archive document (d0)

Tool Experiment Description Document	Category	Authors	Subject	Files
JCTVC-A301	tool experiment description	M. Wien (RWTH Aachen Univ.)	Tool Experiment 1: Decoder-side motion vector derivation	archive document

Tool Experiment Description Document	Category	Authors	Subject	Files
		Y.-J. Chiu (Intel Corp.)		
JCTVC-A302	tool experiment description	T. Chujoh (Toshiba)	Tool Experiment 2: Internal bit-depth increase (IBDI) and memory compression	archive document
JCTVC-A303	tool experiment description	A. Krutz (Tech. Univ. Berlin) A. Glantz (Tech. Univ. Berlin) T. Sikora (Tech. Univ. Berlin) J. Park (LG) E. François (Technicolor) P. Yin (Technicolor) P. Chen (Qualcomm) X. Zheng (Huawei) H. Yu (Huawei)	Tool Experiment 3: Inter prediction	archive document (r1)
JCTVC-A304	tool experiment description	X. Wang (Qualcomm)	Tool Experiment 4: Variable length coding	archive document
