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Federal Communications Commission
Office of the Secretary

May 7, 1991

The Honorable Alfred M. Sikes
Chairman, Federal Communications Commission
1919 M St. NW
Washington, D.C. 20554

Dear Mr. Chairman,

Thanks for giving me the opportunity to make a presentation to the Commission's *Networks of the Future* inquiry last Wednesday. I hope my testimony and the enclosed information help further understanding of some of the significant issues posed by the inevitable convergence of telecommunications, television, and computing.

I found the testimony both informative and provocative. I am impressed by the growing sense of excitement surrounding the beginning of dramatic changes in our communications infrastructure.

It was also good to hear the Commission's interests and questions. I am pleased to enclose, as you requested, a summary of information on some emerging issues regarding the relationship of HDTV to image based computing and telecommunications. Several issues are briefly defined and discussed: *HDTV interoperability, extensibility, scalability, and harmonization* . Growing interest is these issues is driving research which could lead to technology enabling an intelligent, digitally-based high-resolution video system to be useful for a variety of both broadcast and non-broadcast applications across a wide range of communications media.

An American HDTV standard for terrestrial broadcast created in such a wider context would require thorough consideration of related imaging standards being developed concurrently by various computing and telecommunications bodies. Carefully crafted, this digital HDTV standard would enhance the development of a powerful, flexible new communications infrastructure, and thereby provide both significant new business opportunities for a wide range of American enterprises and improved facilities for public activities such as scientific research, education and health care systems. Given the position of the United States as a leader in communications, such a standard might also have an excellent chance of achieving worldwide acceptance.Subsequent economies of scale could stimulate high quality, low cost, communications services to growing segments of the population.

Thanks again for your interest. Please let me know how I may be of further assistance. I would be glad to help in any way I can.

Yours Truly,

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Enclosures (9)

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Selected Issues: Interoperability, Extensibility, Scalability, and Harmonization of HDTV and Related Standards

Comments to The Federal Communications Commission

Prepared by
The Committee for Open High Resolution Systems
Michael N. Liebhold, Editor

May 7, 1991

The following points are generally understood by many of the proponents competing for an American HDTV terrestrial broadcast standard. It is possible that, given a sufficient extension to the current FCC ATV test process most, if not all, of the digital systems proposals could be modified to satisfy the following issues:

Interoperability - *The capability of operation between different video and image formats.*

Context: An intelligent HDTV system will be useful for a variety of non-broadcast high definition applications which might include: teleconferencing, educational video from compact discs and other mass storage, corporate training, medical diagnosis and collaboration, scientific research collaboration, and on-line commercial services like multiple-listing housing pictures, car-sales classified ads with pictures, etc.

• The specifications for any American HDTV standard should be selected to optimize, wherever possible, interoperability between broadcast television, multi-media computers, graphics workstations, color hardcopiers, video recorders, cd-rom and future mass storage devices, film recorders, film and still image color scanners, world-wide video formats, narrow and broadband computer network and interconnection protocols, satellite spectrum width, cable channel modulation schemes..

• To simplify code and hardware, and minimize costs, it is feasible to select scanning standards for HDTV as a super format which have natural relationships among: 24 frame-per-second film source material; 59.94 Hz NTSC TV; 50 Hz Pal and SECAM TV; and typical computer workstation displays operating at >70 Hz flicker rate. It is possible that a master HDTV scanning parameter could be selected (i.e. 2048x1152x72fps) which would not only minimize the costs of interoperability, but would also be attractive as a possible international standard. With proper design, this can be done without increasing costs for the typical HDTV consumer. It should be possible with scalable designs to ensure that both low-price, low feature sets and high-end sets will be practical for HDTV. *It is not clear that the FCC ATV has given serious considerations to format compatibilities with non-broadcast systems in the evaluation procedures for proposed HDTV standards.*

International distribution: From the viewpoint of the health of U.S. exports, it would be extremely valuable if HDTV system parameters made it easier to sell video and films internationally. The current HDTV proposals before the FCC are designed with a relationship to NTSC, but do not have an easy conversion relationship to PAL and SECAM, nor the systems already decided upon in Europe, a market which is growing even faster than the domestic market. The European and other foreign proposals have been rejected by U.S. television and film interests for good technical reasons, and in addition, being analog systems, do not have built-in extensibility for the future nor compatibility with computer systems. However, the U.S. has an opportunity to adopt all-digital systems which would be both efficient for terrestrial spectrum and easily convertible to overseas HDTV.

Extensibility - *Ability of a video standard to incorporate extended functions over time.*

Context: We are witnessing an explosion of developments of new digital processes for video compression and communications across increasingly diverse media. How can we ensure that any HDTV standard established in the 1990s will adequately anticipate future improvements and consequent radical cost reductions for image processing? Solutions, not now part of the FCC ATV process, would include:

• Video streams which are self-identifying, so that receiving systems may intelligently decide which decoding process to apply. The use of a 'header' descriptor or 'side channel' has been proposed. This idea has received widespread enthusiastic response internationally, has been adopted by the CCIR harmonization working party, and is inherent in CCITT imaging standards for B-ISDN. It should be introduced into the ATV process in the U.S.

• Establishment of a header descriptor format for HDTV requires explicit coordination with other international bodies defining related communications, video, and multi-media document protocols especially the ISO, IEEE, and others.

Scalability - *The degree video and image formats can be combined in systematic proportions.*

Context: In order for a future intelligent HDTV system to successfully decode a variety of formats from different sources, flexible 'family' relationships between image standards could significantly reduce costs. Lower resolution pictures may be nested, or embedded within high definition pictures. These schemes would define variable (but related) rather than fixed parameters for resolution, image size, and frame rate. The parameters would depend on processor power, memory availability, and communication channel limitations permitting absolute minimum cost (and capability) consumer devices as well as well as extensibility for capabilities using technology not yet possible.

• It possible that such hierarchical coding schemes will enable several types of flexibility:

1. Different "terminal devices" capable of displaying differing numbers of pixels accessing the same data stream.The quality of the picture would depend on the hardware investment chosen by the consumer, and the capabilities of the software transmitted.

2. Reasonable picture quality maintained despite variations or interruptions in data supplied to the receiver by transmission channel. This is a critical design element for variable bit-rate networks such as B-ISDN using ATM. *((Asynchronous Transfer Mode)*

3. Multiple video 'windows' of different quality source formats could be more easily displayed simultaneously on one monitor. This would permit reception on the same American HDTV set of European 50 Hz HDTV and 24 fps film (upgraded to a non-flicker rate) *without* expensive conversion.

• Variable bandwidths: It would be useful for a given HDTV signal to be able to interact with varying channel loads while sharing a channel with other HDTV signals. This is called "graceful degradation" and goes very far towards maximizing the efficiency of spectrum use, a goal which is mandated in the FCC act. Digital HDTV designs are naturally somewhat "elastic" in respect of graceful degradation and maximizing spectrum utility. However most of the current HDTV proposals do not exploit this extremely valuable elasticity with one exception (a proposal developed to be compatible with asynchronous broadband ISDN). When a channel is heavily loaded with many simultaneous picture streams, it would be useful if each picture stream were still the best that it could be within its reduced allocation of data bandwidth. When the channel is lightly loaded, it would further be useful if the high definition images using the channel could expand to provide maximum quality during the light load conditions. Research has shown that such applications are quite feasible with current technology -- analog and digital.

Such a 'family' relationship already exists among international video telephony standards (CCITT & ISO H.261), JPEG still image standards and, to a somewhat lesser degree, MPEG moving picture standards for compact disc. All four of the current FCC digital HDTV proposals are based on related coding architectures similar to these standards, but have stopped short of fully scalable implementations. Given sufficient additional time by the FCC, these proposals may be modified to incorporate much greater scalable functionality.

Harmonization: *The organization of different standards efforts into an orderly process.*

Context: At some point in the future,it is inevitable that an intelligent HDTV device will be required to process video formats from a variety of different sources including videotape,mass storage (optical & magnetic), telephone wire pairs, cable TV, direct broadcast satellites , fiber-based broadband ISDN and perhaps standards from overseas HDTV systems.

Coincident with the development of an American HDTV standard, a number of other international bodies are evaluating related imaging standards. The most important international fora are the International Telecommunication Union (ITU) and the International Organization for Standards (ISO). In the United States, ISO work on video communications is occurring in the Joint Picture Experts Group (JPEG) for compressed still images and Moving Picture Expert Group (MPEG) for compressed moving images on compact discs . For ITU issues, the US National Committee for the CCIR works on broadcast technologies, while the parallel CCITT committee works on wireline network standards such as video telephony and variable bit-rate encoded video for Broadband ISDN.

• In order to minimize costs to the consumer imaging devices, it is desirable for these emerging standards to be created in a coordinated fashion. It may not necessarily be a requirement that a future HDTV be fully backward compatible with all lower resolution formats, but at the minimum it would be in the public interest if the terrestrial HDTV standard did not *preclude* a low cost, multi-standard set. *Other than discussing other television modes (cable, DBS, etc.) the FCC ATV process, so far, has not included consideration of imaging harmonization issues in the proposed evaluation of U.S.terrestrial systems.*

The preceding information was prepared as a result of efforts by a group of individuals (known informally as COHRS= the Committee for Open High Resolution Systems) who have met and corresponded over the last two years. Much of the material here has been released previously at conferences sponsored by the National Academy of Sciences, IEEE/USA and in response to various U.S. CCIR working parties. Many of these individuals and their organizations would be willing to provide additional information to the Commission.

Michael N. Liebhold, Editor

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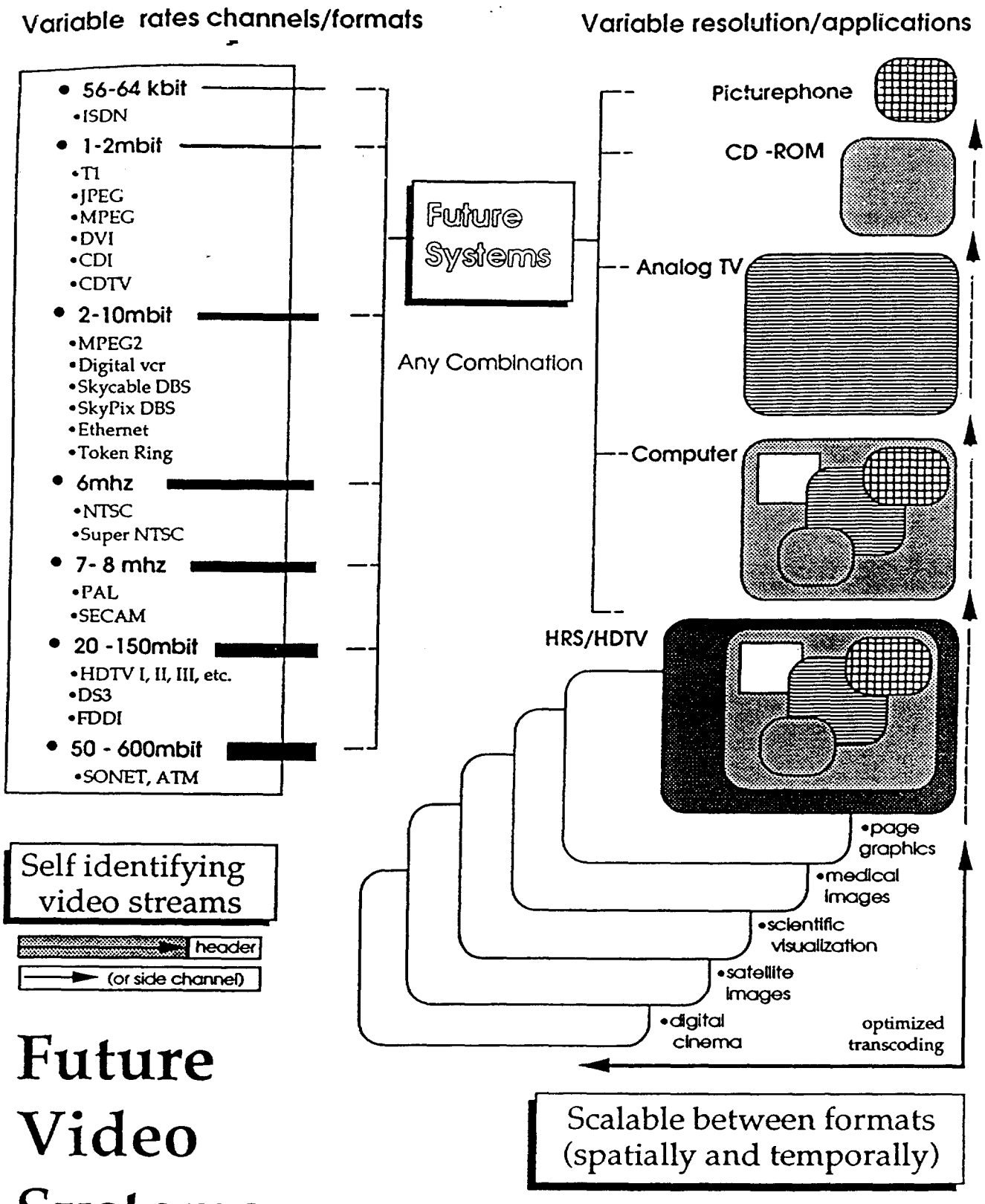

Future Video Systems

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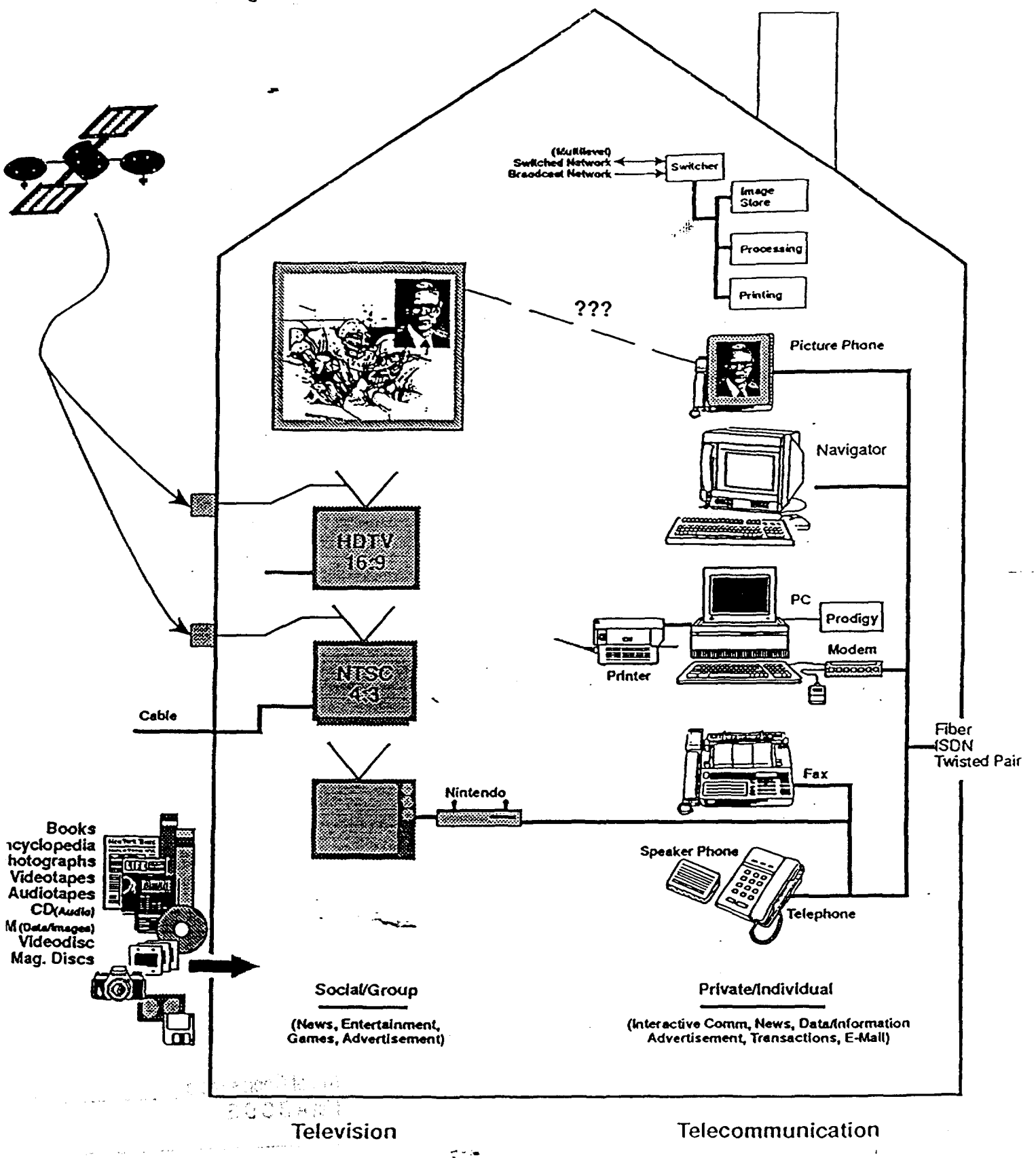
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