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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C 20554

In the Matter of	)	
	)	
Carriage of the Transmissions	)	CS Docket No. 98-120
Of Digital Television Broadcast Stations	)	
	)	
Amendments to Part 76	)	
Of the Commission's Rules	)	

Comments Of New World Paradigm, Ltd.

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CS Docket 98-120(FCC 98-153)
Comments Of New World Paradigm. Ltd.

SUMMARY

Our software system achieves digital compatibility between broadcasters, TV set makers and cable operators more effectively than hardware without disrupting the industries. *The software system decouples TV set design, manufacturing and video production from hardwired standards, thus providing flexible, resilient standards to coordinate the broadcast and reception of digital signals.* The software system is named UVICS, Universal Visual Image Communications System, and it requires no input from the consumer. The system allows video producers to vary resolution and aspect ratios far beyond the limits set by the ATSC's 18 hardwired standards because UVICS treats a video stream as data, encoding it at the broadcast source and restoring the data and all of its DTV enhancements at the UVICS-equipped TV set. Set-makers who equip their TVs with a UVICS receiver preserve DTV's value to the video producer and the television viewer while reducing production costs for a digital TV set since it no longer requires chipsets to hardcode standards. UVICS makes digital sets more affordable and increases consumers' acceptance of DTV because a UVICS equipped TV set does not become obsolete when standards change. UVICS increases capacity by 33% for broadcasters and cable operators because the software system eliminates the need for vertical and horizontal synchronizing pulses, equalizing pulses, scanning sequences and scanning lines.

Cable operators' capacity constraints would practically disappear if the cable TV business adopted the Internet's efficient "channel addressing" communication principle in lieu of the "headend" principle, a legacy notion stemming from the Community Antenna model of cable TV. The NPRM clothes itself in legacy thinking by treating today's cable TV business as if it is forever dependent on a "headend" to deliver services. There is an alternative. The Commission should make rules to allow or motivate cable operators to deliver services through the Internet's "channel addressing" method. It utilizes existing capacity very efficiently and is an embarrassment of riches when compared to the paltry "headend, " which severely restricts the utilization of existing cable capacity. The Internet's "channel addressing" method serves well the public interest, thus the Commission should expand the statutory definition of a cable channel so that a cable operator may lawfully meet "must carry" obligations through a wired network's video-servers. This is a much-needed alternative to the "headend" which forces cable operators to choose between devoting their limited capacity to revenue-producing Internet service or to digital carriage, thus creating a zero-sum game between the DTV market and the cable industry. Expanding the statutory definition of a cable channel sets the stage for a win-win situation between the DTV market and the cable industry and positions cable TV to be a communications medium merging voice Internet and video services into a characterless digital data stream.

COMMENTS ON CS DOCKET 98-120(FCC 98-153): NEW WORLD PARADIGM, LTD.

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COMMENTS ON NPRM - CS DOCKET 98-120(FCC 98-153):

NEW WORLD PARADIGM, LTD.

INTRODUCTION

New World Paradigm, Ltd. is a research firm specializing in the development of communications and video technologies. NWP directs its comments to the NPRM's technical context. Based on our review of the digital compatibility[1] and capacity[2] discussions in the NPRM, and the Commission's request that commenters refresh the technical record,[3] we believe the NPRM's technical context is too narrow to be the exclusive technical basis for making rules. Our comments are divided into two parts.

Part I is a response to the NPRM's request for updated information on digital compatibility[4] and explains that our software system achieves digital compatibility between broadcasters, TV set-makers and cable operators more effectively than hardware without disrupting the industries. The software system decouples TV set design,

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[1] See NPRM Par. 18

[2] NPRM Par. 60

[3] NPRM Par. 93

[4] See NPRM Par 18. "We note that the various technical elements involved in digital broadcast signal carriage are constantly in flux as technology advances. We set forth our basic current understanding of the applicable technical context and seek comment and updated information relating to this review."

manufacturing and video production from hardwired standards, thus providing flexible and resilient standards to coordinate the broadcast and reception of digital signals. The software system is named UVICS, Universal Visual Image Communications System, and it requires no input from the consumer. The system allows video producers to vary parameters such as resolution and aspect ratios far beyond the limits set by the ATSC's 18 hardwired standards because UVICS treats a video stream as data, encoding it at the broadcast source and restoring the data and all of its DTV enhancements at the UVICS-equipped TV set. Set-makers who equip their TVs with a UVICS receiver preserve DTV's value to the video producer and the television viewer while reducing production costs for a digital TV set since it no longer requires chipsets to hardcode standards. UVICS makes digital sets more affordable and increases consumers' acceptance of DTV because a UVICS equipped TV set does not become obsolete if standards change. UVICS increases capacity by 33% for broadcasters and cable operators because the software system eliminates the need for vertical and horizontal synchronizing pulses, equalizing pulses, scanning sequences and scanning lines

Part II is a response to the NPRM's discussion of cable operators' capacity constraints. Cable operators' capacity constraints would practically disappear if the cable TV business adopted the Internet's efficient "channel addressing" communication principle in lieu of the "headend" principle, a legacy notion stemming from the Community Antenna model of cable TV. The NPRM clothes itself in legacy thinking by

treating today's cable TV business as if it is forever dependent on a "headend" to deliver services. There is an alternative. The Commission should make rules to allow or motivate cable operators to deliver services through the Internet's "channel addressing" method. It utilizes existing capacity very efficiently and is an embarrassment of riches when compared to the paltry "headend," which severely restricts the utilization of existing cable capacity. The Internet's "channel addressing" method serves well the public interest, thus the Commission should expand the statutory definition of a cable channel so that a cable operator may lawfully meet "must carry" obligations through a wired network's addressable video-servers. This is a much-needed alternative to the "headend" which forces cable operators to choose between devoting their limited capacity to revenue-producing Internet service or to digital carriage, thus creating a zero-sum game between the DTV market and the cable industry. Expanding the statutory definition of a cable channel sets the stage for a win-win situation between the DTV market and the cable industry and positions cable TV to be a communications medium merging voice, Internet and video services into a characterless digital data stream.

PART I - COMPATIBILITY

A. *The Television Industry's Conflict Over Compatibility*

Until the advent of digital TV the television industry had been a fine example of cooperation between the widely divergent parties Broadcasters, TV set-makers and cable operators worked in tandem delivering a finely honed product to a public anxious to enjoy video communications technology. However, the era of cooperation may be at an end according to the NPRM

> a television broadcast station transmission, a cable television distribution system, and a television receiver In the new digital environment, however, neither law nor regulation standardizes every element. How the multiple technical systems will function in a digital environment remains to be seen [5]

It is true, without standards multiple technical systems may not be compatible with each other in a DTV environment. After suggesting the potential lack of compatibility between multiple technical systems, the NPRM says:

> We set forth our basic current understanding of the applicable technical context and seek comment and updated information relating to this review

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[5] NPRM Par. 18

NWP responds to this request. We have developed a software system that establishes compatibility between multiple technical systems in a digital environment, that makes standards easily amenable to innovation improvement and sunsetting without disruption of entire industries. The software system is UVICS -- Universal Visual Image Communications System.

B. *Balancing Standards and Innovation*

The UVICS system provides balance between innovation needed for technical progress and standards needed for compatibility. The need for such a balance in the DTV industry has already been brought to the Commission's attention by Senator John McCain's sensible advice about technical standards.

The Senator's October 8, 1996 letter[6] to the Commission emphasized the importance of flexible standards for advanced television services.

> The Commission should not Act to merely rubber stamp the decisions of concerned industries... The marketplace, not the government is best able to develop a flexible, dynamic standard that will best serve the public and encourage industry competition and innovation in the future. Further if a standard is adopted, it is absolutely crucial that it be sunset at a date certain

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[6] Filed in MM Docket 87-268

The NPRM appears to address the need for flexibility. Midway through Par. 19, the NPRM uses the phrase **"Under the ATSC's highly flexible standards"** to laud the ATSC's standards and to begin a recitation of their virtues:

> ...It is possible to transmit high definition pictures and high quality sound, multiple standard definition pictures, and other ancillary related or unrelated communications, with the mix of services changing dynamically from second to second. The video content may be transmitted in progressive scan or in the interlaced transmission format. Pictures may be transmitted in a standard definition format, such as 480 progressive, or in a high definition format.

But just as soon as the praise ends[7], the NPRM backs away from the ATSC standards by saying in footnotes 63 and 69 respectively:

> These specific formats were not incorporated into the Commission's digital television broadcast standards. The standard we adopted differs from the ATSC DTV standard in that it does not include the ATSC specifications with respect to scanning formats, aspect ratios, and lines of resolution.

The NPRM's contradictory praise for "highly flexible" standards that were not flexible enough to be adopted by the Commission is a continuing reflection of the debate over standards and compatibility between multiple technical systems. However, the main barrier to compatibility is the assumption that standards can be met only through hardware. This assumption causes many problems.

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[7] There is one constant, unchanging and inflexible aspect of the ATSC standards: they all begin with MPEG, a one-size-fits-all compression scheme applied to each and every television program.

For example, no one knows if television audiences will have a favorite among the 18 ATSC scanning formats. Broadcasters are not sure which format to emphasize and set makers are in a quandary. DTV sets may be very costly if all 18 standards are built into 1 television set. Set makers have the option of lowering costs by making sets that satisfy only a portion of the ATSC formats. Buyers who purchase such "diminished sets" may not be able to watch higher resolution television programs. Upgrading to a higher ATSC or other standards could be expensive and may suppress DTV set sales. More importantly, hardcoded standards assure there will never be a nineteenth or twentieth standard, as suggested by Senator McCain's quote of Supreme Court Justice Breyer: "Standards once set prove relatively immune to revision." And if there were a 19th and a 20th standard that proved popular, they would obsolete all TV sets that had been hardwired for the original 18 standards.

- **The DTV market is caught in a terrible dilemma: Future system-formats could make current DTV sets obsolete but the threat of obsolescence suppresses new DTV formats. UVICS removes the dilemma.**

C. *Compatibility of Multiple Technical Systems in a DTV Environment Is Achieved Through A Universal Visual Image Communications System – UVICS*

The software takes advantage of a simple principle in a Digital TV environment:

- **Television Pictures Are Represented By Data, And Data Can Be Managed By Software.**

Therefore, any of the 18 ATSC formats *or future digital formats* can be handled by software, an alternative to having microchip sets and other hardware-fixed systems built into receivers. A software approach simplifies manufacturing and reduces production costs for DTV sets allowing them, for example, to display images upwards of a million pixels and higher for no more cost than if a set were hardwired to display only 300,000 pixels. Cost effective software-implemented standards means that a single generation of digital sets can display more pixels more flexibly and more inexpensively, thus launching DTV's virtuous cycle and improving DTV's market value.

1. *DTV's Virtuous Cycle and DTV's Market Value*

DTV's virtuous cycle is straightforward

- flexible standards means a single line of sets can display more and more pixels;
- more pixels mean better picture-detail in a digital TV;
- better detail means more consumers prefer digital sets to analog sets;
- a greater preference for digital sets means more consumers accept DTV;
- consumer acceptance means more demand for DTV enhanced programs;
- more demand for DTV programs means more demand for flexible standards.

The virtuous cycle shows that DTV's market value is directly related to the quantity of pixels and their bit count.[8] If the DTV pixel quantity and bit counts are only marginally higher than their analog counterparts, a DTV environment provides little added value to the video market, which calls into the question the wisdom of switching from an analog environment. Therefore, a DTV environment is valuable to video service producers and viewers only if its pixel and bit counts far exceed the counterparts in the analog world. A successful switch from an analog environment to a dynamic DTV environment requires that the huge increase in the video systems' data throughput be managed by flexible cost-effective software systems such as UVICS.

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[8] There is some variation in this rule in the sense that motion aberrations caused by MPEG 2 make 1080 interlace scan less attractive then a 720 progressive scan. But this is not a problem caused by pixel density but by the compression algorithm.

2. *UVICS' Highlights*

UVICS manages end-to-end data steams in digital mode and can be implemented by broadcasters and television set makers while evolving as necessary to meet new standards, which no longer have to be built into hardware. No viewer input is required. UVICS' highlights are:

- The elementary picture-data stream may be produced according to ATSC standards, PAL standards or other standards because aspect ratios[9] and all other formatting parameters can be treated as variables rather than being limited to specific values, thus giving tremendous flexibility to video program producers, who can carve out markets unique to their talents and target new production techniques on certain audiences willing to pay for the crystal clear benefits of DTV;
- UVICS eliminates the need for synchronizing and equalizing pulses, scanning sequences and scanning lines, thus raising video system capacity by 33% for broadcasters and cable operators;

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[9] In a video network where the entire delivery path is wired, channel width can be a variable and not necessarily limited to 6 MHz. Refer to the comments in Part II for a discussion of how channel width becomes a variable in a wired network.

- UVICS encodes the elementary picture-data stream and creates along with it a tiny "instruction program" that tracks the DTV image's data stream and tells the receiver how to decode the elementary stream;[10]
- UVICS' instruction program is tiny in comparison to the quantity of data in the elementary-picture data stream no matter how complex the instruction program;
- Instruction programs are sent to the receiver ahead of the elementary bit stream to enable reception, and the sending may be done in at least 2 ways;

    1. The instruction program can immediately precede the elementary stream as part of the overall data flow;
    2. An instruction program(s) corresponding to a television program(s) can be placed on a storage medium (such as a Digital Video Disc) in the television set which matches a "message header" on the elementary stream with a header on the storage medium so the particular program is properly decoded;

- Set makers may build video display units with highly reliable, high speed processors to read the instruction program and decode the elementary stream, optimally fitting the picture's data to the set's size, resolution and other display capabilities;

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[10] No instruction program need be transmitted for NTSC and ATSC signals or any other fixed standard. Instruction programs for fixed standards can be resident in the UVICS receiver or updated from a CD or other digital storage device.

- If the resolution of the source material is higher than the resolution of the DTV set, the instruction program optimally adjusts the source material's resolution to match the set's resolution rather than depriving the viewer of the program – a flexibility that is not currently available or planned for;
- Television set makers can use one UVICS production line to meet any and all standards instead of creating various manufacturing production lines to meet all or part of the 18 ATSC codes and other fixed standards in the world-- the potential economic impact being a lowering of production costs and a greater likelihood of DTV sets being affordable worldwide;
- The flexibility provided by UVICS decouples TV set design and manufacturing from hardwired standards, thus allowing a nineteenth standard, a twentieth, a thirtieth and so forth to be broadcast and received

At the discretion of the video producer, UVICS may use a dynamic compression scheme based on the well known observation that large portions of television picture do not change from frame to frame. The video producer may vary compression algorithms within a TV program or from program to program. This is a further example of the flexibility offered by UVICS and a marked difference from MPEG 2, a "one-size-fits-all" compression algorithm.

PART II – CABLE TV CAPACITY

The NPRM's discussion of capacity presents 3 options:

> We see three possible options in determining capacity: (1) each programming service counts as one channel; (2) each 6 MHz block of spectrum counts as one channel; or (3) the digital capacity should be by data throughput, i.e. bits per second of digital data.

However, at Par. 93 the NPRM says:

> We ask that commenters refresh the record on the specific technical modifications needed to enable cable systems to deliver digital broadcast television to subscribers. We ask what the costs will be for such modifications, particularly for new headend equipment ...

The reference to "headend" in Par. 93 and the 16 other appearances of "headend" in the NPRM implies that the technical context regarding capacity is wedded to the legacy concept of Community Antenna TV, where the delivery of cable service is forever dependent on a "headend" antenna. Apparently no alternative concepts were considered, and the Internet communications model is conspicuously absent. For example, the NPRM makes no inquiry and requests no comments on the relationship between the cable industry's delivery of Internet services and the "must carry" proposals such as Immediate Carriage, System Upgrade and Phase-In. In fact, the NPRM refers to the Internet in just 2 places – Procedural Matters and in footnote 75. The NPRM would be woefully incomplete if it ignored the Internet. We offer our comments to enhance the

record and advise the Commission to craft final rules that embody the vitality of Internet communications.

A. *The "Headend" Principle Creates a Zero-Sum Game Between The DTV Market And The Cable Industry*

The "zero sum" concept is simple to understand: "Your gains are my losses." This concept certainly applies to the DTV market and the cable market. As discussed earlier, DTV's market value improves only if the pixel and bit counts far exceed those counts in an analog environment. But efforts to expand pixel quantity and bit counts directly conflict with the cable industry's intended use of its own limited resources. The conflict is readily apparent in light of OPP's working paper, "Internet Over Cable: Defining the Future in Terms of the Past," released by the Commission in August. Regarding the statutory definition of a cable channel, the working paper says:

> There does not appear to be anything in...the definitions relating to channels that would preclude consideration of cable Internet-based services as being provided over a cable "channel," and it is likely that is how system operators are currently providing that service.[11]

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[11] See Office of Plans and Policy's Working Paper 30 "Internet Over Cable," pp. 104-105.

Assuming the paper's statement is accurate the NPRM's various "must carry" proposals present the cable industry with an excruciating choice between carrying revenue producing Internet services, which will surely grow during the years covered by the "simulcast" obligation, versus carrying DTV signals Therefore, cable operators can be expected to meet their "simulcast" obligation while conserving their cable capacity to use it for other activities that will contribute to the industry's profitability.

One way for cable operators' to achieve both goals is to transform the broadcasters' original signals into a format which conserves capacity. After receiving a broadcaster's 8 or 16 VSB modulated signal, cable operators' intend to transform it to a QAM signal to handle the higher bit rates of DTV Broadcasters worry that such a transformation will materially degrade their original signals and deny consumers the benefits of DTV.

All the problems have their source in the Community Antenna model of cable TV, where one "headend" antenna takes in all channels and passes them on to subscribers. The headend principle dominates everyone's perception of the cable TV business and constitutes a cable channel's statutory definition "channels ..engineered at the headend of a cable system for the provision of services generally available to residential

subscribers..." [12] Even the law cannot define a cable channel without referring to a headend antenna. However, the headend principle has a severe operational disadvantage -- it places all channels in the cable at every moment, even when the channels are not watched. The peculiar and inefficient result is that most of the cable's capacity is used up by the channels that *are not* being watched, instead of the channel that is being watched.

B. *The Internet's "Channel Addressing" Principle Is An Alternative Way for Cable Operators To Meet "Must Carry" Obligations And Should Be Made Lawful*

The headend principle is so powerful that it dominates the perception of how "must carry" obligations will be met. The NPRM's technical discussion assumes that DTV signals will be compressed and modulated until they are made to fit within the cable operators' limited capacity. There is another way to meet "must carry" obligations:

- **Expand the statutory definition of a "channel" to include the Internet's more efficient use of capacity.**

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[12] Id.

For example, an Internet user can select an Internet address, use the address's services and then move on to other addresses and services without having all of them reside moment-by-moment in telephone drops, cable feeders, trunk lines and backbones. The "address" principle utilizes capacity far more efficiently than the headend principle. The Commission should allow the address principle to operate in the TV industry by expanding the statutory definition of a cable channel

> A channel is also any Internet-addressable video service engineered for the electromagnetic spectrum carried solely in wired networks from the producer of the video service and delivered through a video-server and made available for and to subscribers of a cable system.

Accessing a channel residing in a video server and then sending the channel to the subscriber is a far more efficient way of utilizing cable capacity than shipping all channels to the subscriber at the same time. Therefore, expanding the statutory definition of a cable channel as proposed here ensures that the law recognizes channel-addressing through the Internet as an alternative way to meet "must carry" obligations.

Once channel-addressing attains a lawful status as a means of transport for "must carry" DTV signals, new minimum technical performance standards for digital signal transport through the wired medium could be set to assure that its "must carry" quality at least equals the "must carry" quality achieved through the headend approach. The Commission's final rules should allow for the expanded definition and its matching technical standards. Failing that, the Commission should propose rules that allow cable

operators an opportunity to use channel addressing to meet "must carry" obligations, rather than confining operators to the legacy method of hauling a channel and all of its unwanted companions from the headend to the subscriber

C. *Advantages Of Channel Addressing For Broadcasters*

Channel addressing will affect the Internet's architecture because a video server can house many channels, thus giving broadcasters the freedom and incentive to offer their end-to-end services completely through the wired network. Wired network technology may be attractive to broadcasters since it potentially offers large amounts of bandwidth to deliver a DTV signal from its source to a cable subscriber, just as effectively as the radiated spectrum.

Wired networks may also be attractive because UHF and VHF analog transmission will permanently sunset in 9 years These relatively long-wave length techniques requiring a central transmitter with a liability of an over-the-horizon reach may give way to very-short-wave length techniques using small distributed transmitters that receive their video signal by wire and then broadcast it over short distances. Additionally, preserving the community antenna notion to the exclusion of a wired video network is counter intuitive, considering that upwards of 65 percent of television viewers nationwide, and an even higher percentage of urban viewers, receive their TV programs

through cable. Expanding a cable channel's definition as proposed here will also give the market impetus to use the huge amounts of backbone capacity now being installed throughout the country.[13]

The potential for delivery of television services through a wired video network is recognized in the ATSC Digital Television Standard of September 16, 1995. Section 4.5 of that standards document. "Principles for Documenting the Digital Television Standard," says:

> The advanced television system documentation shall address interoperability with non-broadcast delivery systems including cable.

A flexible standard that allows for the possibility of a wired video network also allows for the headend to be replaced or "paralleled" by a broadband connection to the worldwide network. This may be advantageous because the worldwide network is rapidly adding infrastructure. Nortel, for example, is investigating a terabit/petabit[14] manager that may redefine switching, routing and interconnection in wired networks. In a completely digital network with sufficient bandwidth, the modulation scheme could be

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[13] See "Comments of QWEST Communications Corporation," in CC docket 98-146, dated Sept. 14, 1998

[14] A petabit is 1,000 trillion bits per second. See "The Nortel Edge," 1998/2, P. 10

VSB, QAM or other digital possibilities. A wired network has advantages for broadcasters:

- Television stations no longer trade off area-coverage and interference;
- Interference disappears and coverage is as broad and reliable as the wired network itself;
- Television programs no longer have to fit within a 6 MHz channel width because channel width is not a meaningful parameter in an addressable wired network;
- Television stations that lose markets when UHF and VHF transmissions are sunset may regain the markets by adopting very-short-wave length transmission techniques and using small distributed transmitters fed by wired network to reach audiences not accessible by wire;
- Local and low power stations retain the ability to compete while also reaching a broader audience;
- The video services market becomes more competitive;
- The number of possible channels expands dramatically.

The Commission has already noted that "the various technical elements involved in digital broadcast signal carriage are constantly in flux as technology advances." To be consistent with this observation, the Commission should adopt rules allowing cable operators an opportunity to apply the Internet communications model to "must carry"

obligations. Giving cable operators this opportunity is especially timely because many of them have not yet commenced a system overbuild and are still evaluating alternatives.

D. *Channel Addressing Implements Video On Demand and Requires Instant Access To Digital Networks*

We believe instant access will be easily achieved because:

- High speed fiber optic backbone capacity is expanding very rapidly and will provide ample capacity for digital video signals;
- The private sector is well along the development path for video servers.

These activities are ready made advantages for cable operators who have yet to rebuild their backbone networks to handle "must carry." If the headend were replaced or paralleled by a broadband connection to the worldwide network, then instead of linking the "new headend" to the existing or an expanded Hybrid Fiber-Coaxial backbone:

- Link the "new headend" to *a new backbone* composed of many so-called "fat fibers," a multi-pair fiber bundle housing hundreds or thousands of single mode fiber optic pairs that provide multiple and independent paths guaranteeing the subscriber instant access to video servers and other portions of the world wide network;