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The IPtX Specification Expands the 'CIDR' Architecture, with a Definition of CIDR and the Network Descriptor

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Abstract

This paper Builds upon existing works and 'Works in Progress' that provides the foundational bases for the expansion of the 'CIDR' Architecture, and the Definition for CIDR and the Network Descriptor'. However, this work should only be considered an extension, hence, the Obsolescence of RFC's 1517, 1518, and 1519, because the Hardware and Software specifications has been implemented, and this work only extends the foundation they jointly established.

"This work is Dedicated to my first and only child, 'Yahnay', who is; the Mover of Dreams, the Maker of Reality, and the 'Princess of the New Universe'. (E.T.)"

Epilogue: The 'CIDR' Architecture, and Developing a Foundation for Change

The Classless Inter-Domain Routing Architecture, or CIDR, was derived from the so called; "strategies for address assignment of the existing IP address space with a view to conserve the address space and stem the explosive growth of routing tables in default-route-free routers" [9]. It was in reality, an Expansion of the 'Default Addressing Structures' existing in the Address Class System. And while the popular claim boasted the elimination of the Address Class System. These were nevertheless, the Claims fashioned by the Authors, whose works represented their personal interpretation(s), because the works comprising RFC's 1517, 1518, and 1519 were never fully understood. The truth nonetheless, was clearly explained in RFC 1519, whose discourse dealt specifically with the way the Routers, and the Routing Protocols interpreted, or dealt with the IP Address, and not the elimination of the Address Class System per se. In other words, the Routers and the Routing Protocols were limited to using only the 'Default Addressing Formats', which represented Class A, Class B, and the Class C Addressing Specification. And to deal with the prospect, or the possibility of an IP Addressing Shortage, a plan was devised (RFC's 1517, 1518, and 1519), which actually involved not only the initial 'Default Addressing Formats', from Class A, B, and C, but the remaining fractional subcomponents from each of their respective Octets as well. In fact, while RFC 1519 specifically designed the CIDR Architecture to take advantage of Class C, it did not weaver in its mention of the same implementation for the Class A Specification. It could be said in other words, that the CIDR Architecture represents an Un-Finished version of the 'IPtX Protocol Family Specification'. However, because of the MISNOMER, 'CLASSLESS', the process of SUB-DIVIDING a Class (In particular; Class A, and Class C), was never fully understood. Hence, the CIDR Architecture is the Sub-division of a CLASS SYSTEM, or a Class Addressing System that has been SUB-DIVIDED, which represents the Class, or the Whole, having a Greater Number of Constituents.

In other words, the CIDR Architecture actually represents; The 'Inter-Domain IP Bit Mapped Address Routing Architecture'. Because this, in essence, is what is really happening to the IP Address, and this is the IP Addressing Format that the Router and the Routing Protocols are dealing with. Therefore, the Class Addressing System is a format that implements a Network IP Address using a specified number of BITs, and in this case, it is either '8', '16', '24', or '32' Bits. Needless to say, any further Sub-Division, or use of some Smaller Portion or Constituent, does not constitute a change, nor does this process eliminate the Existence of the Class System. Hence, the CIDR Architecture actually reinforced the Class Concept, and proved without changing the Size or Specification of the 'IP

Bit Mapped Address Class Range', or the IP Bit Mapped Address Space, that the Whole, is indeed the Sum of its Parts.

Chapter I: Staggering the Variables in the Default Addressing Structure: The Reality of the "Laws of the Octet"

There is nothing Mystical nor Spooky about the "Laws of the Octet", because it is simply a guide to the Structure and foundation of the Divisions contained within each of the 5 Address Classes, which also provides the basic Rules for the construction of an IP Address from any one of the '4' Default Addressing Formats. In other words, the Laws of the Octet defines the Structure of the IPtX Address Classes, and explains the '4' Default Addressing Formats as a Staggering, which uses the 'Y' Variable to show the Octets in which the IP Address representing the IP Address Class Range Can Not Be Used. In any case, the '255' specification retains its previous definition, that being the Octet representing the Place Holder, which defines the portion of the IP Address denoting the IP Address Class Range of the Address Class in which it is used. (See Table 1-A, and Ex. 1-A)

Ex. 1-A

> If the Default Addressing Structure is given by; '255.y.x.x'. This would represent an IP Address in which the IP Address Class Range Can only be Used in the First Octet, the Second Octet, occupied by the Variable 'Y", can use All of IP Addresses Except those denote by the IP Address Class Range specified for use by the IP Address Class. In any case, the Octets Occupied by the 'X' Variable, can use any of the IP Addresses, which are contained in the IP Specification itself (Accept of course, when the Older Rules would apply; See Table 1-B).

In other words, other than defining the Structure of the IP Address Classes for IPtX Specification, the Laws of the Octet, does nothing more than specify the rules, or reasons, for Staggering the 'X' and 'Y' variables used in the Default IP Addressing Format. In which case, it should be understood, for every occurrence of the 'Y' variable No IP Address from the IP Address Class Range can be used in the Octet that the 'Y' variable occupies.

Table 1-A

{" The Laws of the Octet "}

'If the "Subnet Identifier specifies the value for the Variable Y", then the "Subnet Identifier" is said to Define the value of every Octet, for All Address Classes, in which the 'Y' variable is assign': Hence;

1. **By definition, there exist 4 distinct Sections or Divisions for every IP Address Class. However, the number of Sections** or Divisions that any IP Address Class can maintain is Mathematically derived, which is related to, and dependent upon, the IP Bit Address Number and the Total Number of IP Addresses defined for the IP Address Classes.

2. **The Sections or Divisions of the IP Address Class are defined as: Primary, Secondary, Ternary, etc...And are labeled** according to their respective Class Location (e.g.: Class A would be Class A-1, Class A-2, Class A-3, and continued as would be necessary to distinguish every Division(s) of the Class, and the respective Divisions of the remaining IP Address Classes; i.e. Address Classes B - E).

3. **The Subnet Identifier assigns to the First Octet within each Section or Division of every IP Address Class, when it is not** use as the Default Subnet Mask, only the value of the numbers available in the IP Address Range assigned to the IP Address Class.

4. **Every OCTET, in every Address Class, which is not defined by the Subnet Identifier, can be assigned any value defined** by the range given by; '1 - 256' (which excludes the use of All Integer '0's'). That is, provided that there is no succeeding Section or Division within the same Address Class, whose reference would be the same OCTET Number, which is Defined by the Subnet Identifier. (In other words, if there is such an OCTET in the succeeding Section or Division, then neither, can be defined by the Subnet Identifier and use All of the Numbers in the Integer Range specified above.)

5. **For every OCTET within each Section or Division of every IP Address Class, that is defined by the Subnet Identifier, and** it is preceded by a Section or Division within the same Address Class, whose reference is the preceding Octet Number. Then, the Octet of the preceding Section or Division must be defined by the Subnet Identifier. (Because with the exception of the First Octet, the Octet of the preceding Section, or Division, must be defined by 'Y', and can NOT be assigned the value denoted by the Integer Range, which DEFINES the IP Address Range assigned to that IP Address Class.)

TABLE 1-B

1. The Network Address portion of an IP address, as Represented by the 'Subnet Identifier', cannot be Set to either 'All Binary Ones' (255) or 'All Binary Zeros'(Which also Bars there use in the Zone IP)

2. The Subnet portion of an IP address, as represented by the 'Subnet Mask', cannot be Set to either 'All Binary Ones' or 'All Binary Zeros'

3. The Host portion of an IP address, characterized as not Being defined by either the 'Subnet Identifier' or the 'Subnet Mask' cannot be Set to 'All Binary Ones' or 'All Binary Zeros'

4. The IP address 127.0.0.0 can never be assigned as a Network Address, because is the 'LoopBack' test IP Address.

Chapter II: The Expansion of the Definition of 'CIDR', the Network Descriptor, and The Obsolescence of RFC's 1517, 1518, and 1519.

When defining the New 'CIDR' Architecture as being the replacement for RFC's 1517, 1518, and 1519, we must first list the functional components, or Highlights, noted as being the objectives or purpose supported by each of these papers, individually. That is, there must be comparison between the definition or description of the functional purpose of the 'CIDR' Architecture as represented in each of these papers, compared with the New 'CIDR' Architecture this paper actually represents.

RFC 1517 (Maintained promoted a fear of IP Address Loss, and Astronomical growth in the size of the Routing Tables):

"- Exhaustion of the class-B network address space. One fundamental cause of this problem is the lack of a network class of a size that is appropriate for a mid-sized organization. Class-C, with a maximum of 254 host addresses, is too small, while class-B, which allows up to 65534 addresses, is too large to be densely populated. The result is inefficient utilization of class-B network numbers.

- Routing information overload. The size and rate of growth of the routing tables in Internet routers is beyond the ability of current software (and people) to effectively manage.

- Eventual exhaustion of IP network numbers."

Argument in Opposition (Justification of the New 'CIDR' Architecture):

It has been previously shown using the New 'CIDR' Architecture (which employs the New 'CIDR' Network Descriptor) that the Reality of IP Address EXHAUSTION, was in fact IP Address Waste, because Viable IP Address that could have been use to establish a Network Connection, outside of the Network Domain, were allocated for the Host IP Address Assignment. Which was clarified by a Comparison of the "Internet Protocol v4 Address Space, and the use of the CIDR Network Descriptor displayed in Table 6:

TABLE 1-C

Internet Protocol t1 Address Space INDEX

IPaddNum = Network IP Address
CIDRNetDescrip = CIDR Network Descriptor

Current Number of IP Network Addresses Issued
Accounts for = 253 IP Network Addresses

Class A	CIDR Network Descriptor
A-1: Issued = 127 , Remaining = 1,040,513,921	/00:08
A-2: Issued = None, Remaining = 516,160,512	/00:16
A-3: Issued = None, Remaining = 256,048,128	/00:24
A-4: Issued = None, Remaining = 252,047,376	/00:32

Class B	
B-1: Issued = 64 , Remaining = 784,514,496	/10:08
B-2: Issued = None, Remaining = 197,672,960	/10:16
B-3: Issued = None, Remaining = 49,807,360	/10:24
B-4: Issued = None, Remaining = 16,777,216	/10:32

Class C	
C-1: Issued = 32 , Remaining = 458,321,632	/110:08
C-2: Issued = None, Remaining = 57,741,312	/110:16
C-3: Issued = None, Remaining = 7,274,496	/110:24
C-4: Issued = None, Remaining = 1,048,576	/110:32

Class D

D-1: Issued = 16	, Remaining = 245,676,912	/1110:08
D-2: Issued = None	, Remaining = 15,475,712	/1110:16
D-3: Issued = None	, Remaining = 974,848	/1110:24
D-4: Issued = None	, Remaining = 65,536	/1110:32

Class E

E-1: Issued = 15	, Remaining = 231,289,845	/1111:08
E-2: Issued = None	, Remaining = 13,658,850	/1111:16
E-3: Issued = None	, Remaining = 806,625	/1111:24
E-4: Issued = None	, Remaining = 50,625	/1111:32

And while the Router's Table Growth remains an ongoing issue, it is not a problem that actually involves the New 'CIDR' Architecture, or the 'CIDR' Architecture in general. In other words, the Size of any of the 'Internet' or 'Globalnet' Router's Table should never approach the size of the Router's table being used by the Largest Network Domain using the Internet / Globalnet Backbone; e.g. the Largest ISP. Nevertheless, the problem here actually concerns the Structure of the Internet's (Globalnet's) Backbone, because it really does not have any structure at all. It is in essence, an aggregation, of what amounts to a Conglomeration of Wires, which does not maintain the Design Specification, nor Structural Continuity, Required in the Wiring Specification of a Single Family Dwelling.

RFC 1518 (Which deals more with the actual Structure of the Internet, or its Hierarchical Structure , and IP Address allocation and Routing, than the actual 'CIDR' Architecture) where by, the points are specified as:

There are two aspects of interest when discussing IP address allocation within the Internet. The first is the set of administrative requirements for obtaining and allocating IP addresses; the second is the technical aspect of such assignments, having largely to do with routing, both within a routing domain (intra-domain routing) and between routing domains (inter-domain routing). This paper focuses on the technical issues.

The architecture and recommendations in this paper are oriented primarily toward the large-scale division of IP address allocation in the Internet.

IP Addresses and Routing

Efficiency versus Decentralized Control

IP Address Administration and Routing in the Internet

Administration of IP addresses within a domain

Indirect Providers (Backbones)*

Continental aggregation*

Argument in Opposition (Justification of the New 'CIDR' Architecture):

While there is a lot that can be said regarding RFC 1518, especially since this is a proposal which advocates a great deal of dependency upon ISP's, whose entire existence is based upon the Economy, the Consumer, and a Volatile Market. Which actually means, an ISP has no guaranteed Future, regarding either the use of the IP Address Base, or their Routers for a thoroughfare. In other words, while this RFC did mention some good points, that are indeed supported in the IPtX Specification. It nevertheless, maintained more the soundings of a White Paper Solicitation for a New System Overall, than an actual presentation representing 'CIDR' Architecture. Needless to say, some of the problems discussed, and emphasized repeatedly, addressed the need for a Internet Hierarchy, while dismissing the need to expand the number of Backbone connections, which is the main point of consideration when addressing the concept of an Internet Hierarchy.

RFC 1519 (While this RFC should be the replacement for RFC 1517, because it is clearly derived from RFC 1517, it claims to Obsoletes RFC 1338, which I have not read. And while this paper also disputes some of the proposals outlined in RFC 1518 {Noting Specifically the causes for a loss of aggregation efficiency; Organizations which are multi-homed, and Organizations which change service provider but do not renumber.}. Nevertheless, one thing this RFC does, that the others so far do not, is that, it Mathematically Introduces the beginnings of Foundation for the 'CIDR' Architecture.)

Argument in Opposition (Justification of the New 'CIDR' Architecture):

Nonetheless, while this RFC introduces the basic Mathematical Foundation for the 'CIDR' Architecture, and sets the fundamentals for the hardware and software specifications for Networking in a Supernetted Environment, it actually does nothing to prevent IP Address wasted on Host Assignments. This is because the foundation of the 'CIDR' Architecture was derived from the IPv4 specification, which means there was no way, short of a New IP Addressing System, could this waste be avoided. Which is not the problem with the IPt1 specification, because it De-Emphasizes the HOST IP Address, and gives it secondary functional value, when compared to the emphases and utilization of the Network IP Address. Needless to say, this was the foundation that was needed to get the 'Ball Rolling'. That is, while RFC 1519 developed the Mathematical foundation for the 'CIDR' Architecture, it never actually, or fully Exploited the benefits this Architecture maintains. Which is nevertheless, now fully exploited in the New 'CIDR' Architecture defined in this paper.

The conclusion in support for the change to the New 'CIDR' Architecture, is actually derived from the definition, or the Meaning of CIDR, and the definition of the CIDR Network Descriptor.

Definition 2

CIDR: (Classless Inter-Domain Routing) Is an IP Addressing Technique, using only Binary Numbers to derive, enumerate, or specify an IP Address that is some Fractional Subcomponent of any one, or Combination, of the '4' Octets comprising an IP Address. And while its original function was specifically the derivation of the Network IP Address for the 'Address Class C', it was later discovered that the HOST IP Address could be derived using the same techniques. This Technique, called Supernetting, has been expanded even further, using the IPtX Specification, which takes full advantage of the total number of IP Addresses and the entire IP Bit Mapped Addressing Specification, as in Ex. 1-B: '1 - 32 Bits'.

CIDR Network Descriptor: It is a short-hand method used to define a IP Bit Mapped Network Address. Where by, the Digits to the Right of the Colon Represents the Starting Point for the IP Address Class Range in Binary Notation, or Network IP Address assigned to the Specified IP Address Class Range that is represented in Binary Notation. And the Digits to the Left of the Colon represents the Bit Mapped Displacement, or the Number of Binary Digits the Network IP Address uses. In which case, the '/XXXX:XX' notation would be used to specify, or Mean, All of the Network IP Addresses Contained in the IP Address Class Specification (The Default CIDR Network Descriptor; ' /XXXX:XX '.)

Nevertheless, while the modern text describing the 'CIDR' Architecture only discusses the Supernetting of the 'Class C', RFC 1519 did in fact lay the foundation for the Supernetting of the Class A and C. Furthermore, RFC 1519 specified the procedures, or changes that needed to be implemented in the Routing Protocols to take advantage of the 'CIDR' Architecture to make the Supernetted IP Addresses Routable. In other words, while RFC 1519 expanded the 'CIDR' Architecture to include the A and C Address Classes, it did not fully exploit the 'CIDR' Architecture, which would have used all of the IP Addresses contained in each of the 5 Address Classes. Needless to say, it should be clear, that RFC1519 did provide the necessary foundation not only for the complete exploitation of the 'CIDR' Architecture, but established the foundation for the 'IPtX' Specification as well.

Moreover, it should also be understood that the Schematic Design of the 'IPtX' Specification is well suited for the 'CIDR' Architecture. This is a feature in the Addressing Methods used in the 'IPtX' Specifications, which allows the complete exploitation of the 'CIDR' Architecture, and the development of the New CIDR Network Descriptor that was defined in Definition 2 and demonstrated in Table 1-C, noted above. Nevertheless, while the depiction of the CIDR Network Descriptor is somewhat different, its functional use, as well as the Supernetting of an IP Address remains the same in the New 'CIDR' Architecture. The only difference that the New 'CIDR' Architecture maintains, is that, it is fully exploited in the IPtX Specification, which incorporates a Schematic Design that makes every IP Address available as viable IP Network Address, and waste no IP Addresses on Host Address Assignments.

Ex. 1-B

Class E-4

```
240-254/1111:25    =   25/~29      =     2^7  =     128
                        |                 |           |
                        V                 V           V
240-254/1111:30    =   30/~29      =     2^2  =      4


240-254/1111:31    =   31/~29      =     2^1  =      2


240-254/1111:32    =   32/~29      =     2^0  =      0*
```

*Note: Using the Current or Modern Method for Binary Enumeration, the solution here, regarding the Supernetting function and 'CIDR', is the Correct answer. However, under the New Binary System, the solution would be; 2^0 = 1, and this would be True because, 'In the New Binary System: When considering the Network IP Address, it must be realized that Not All of the 32 Bit range of the IP Address is used in the Address Class range when dealing with a Æ32 Bit Mapped IP Address SpaceÆ, as in /00:32. Still, if the Subnet IP = 126.126.126.126, then the Host IP Address could equal 126.126.126.127; or respectively 254.254.254.254 and 254.254.254.253. In which case, it should be realized, by definition, that æ255Æ and æ000Æ can not be used.

Chapter IV: Security Considerations

This document, whose primary objective was the explanation of the New definition of CIDR and the Network Descriptor, which resulted from several "Works in Progress", did not directly raise any security issues. Hence, there are no issues that warrant Security Consideration.

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