Institute of Advanced Engineering and Science

International Journal of Informatics & Communication Technology (IJ-ICT)
Vol.2, No.3, December 2013, pp. 155~165
ISSN: 2252-8776

Named Data Networking (NDN), New Approach to Future Internet Architecture Design: A Survey

Zain ul Abidin Jaffri*, Zeeshan Ahmad*, Muhammad Tahir**
* College of Communication Engineering, Chongqing University, P.R.China
** School of Software Engineering, Chongqing University, P.R.China

Article Info

Article history:

Received Aug 15th, 2013
Revised Oct 25th, 2013
Accepted Nov 30th, 2013

Keyword:

Named Data Networking
Future Internet Achitecture
Information-Centric
Content-Centric Networking
Scalability

ABSTRACT

To envision and evolve the Internet into the future, what required is a simple but a vital architectural modification which focuses on "What (the contents)" rather than "Where (the addresses)", that the Internet users and the applications are more concern about. So the communication can be more in effect if the customers can simply identify that what content they want to have instead of from where the content can be possessed. To achieve this and also to make the system more efficient and effective, new internet architecture emerged which we baptized as "Named Data Networking" or simply "NDN" in which packets bring with it the hierarchical data names instead of carrying the source and destination address. In NDN when the customer needs some data, he sends the interest packet which carries the name, is first received by the router and the router then forwards it as per instructed by FIB and uphold the status of pending interest , in further which is used for guiding the retrieved data back to the customer. The main objectives behind developing this architecture are to bring the scalability, efficiency, security and robustness in the current internet state, facilitating the user choice and competition as well. In this paper an overview of different future internet architectural approaches are provided such as CCN, NetInf, PRISP and DONA. NDN as a brand new architectural design among them remains the leading focus and its altered architectural design as a source of fulfilling the above mentioned major issues and objectives.

Corresponding Author:

Zain ul Abidin Jaffri,
College of Communication Engineering,
Chongqing University,
Xuelin Hotel, Chongqing University, Campus A, Shapingba, Chongqing 400030, P.R.China.
Email: zainulabidin.jaffri@gmail.com

1. INTRODUCTION

Thinking about today's network, how much it is boomed now, having 100 million users, looks like a perfect world. But still there is a dark side of it. Dark side which is on the networking side because the problem that net solves is profoundly changed now as having the communication system which talks about the information or stuff. The network today is not like that because today it isn't used for talking about the stuff but it is used for the stuff so it's not a communication system now, it is a distribution system. Taking in consideration everything which is big today, everything which is used a lot i-e Amazon, YouTube, Facebook, twitter, i-Tunes and so on. None of these are about the communication, all are about the distribution. So the main thing is how to convert a communication system in to a good distribution system. This thing act as a big missing hole and what many people in the world are doing is to fill that hole.

The main differences between distribution system and a communication system is that in distribution system it is possible to name the data, in it the memory is explicit and also it focuses on securing the information whereas in communication system we can only name the end points, in it the memory is invisible and it focuses on securing the process of getting information.

The today's applications are characteristically in terms of what that the customer wants rather than thinking about where it is located. This new proposed architectural design for the future internet, termed as "Named Data Networking (NDN)" is a joint research effort in developing the new internet architecture and it is advancement in Content-Centric Networking (CCN). Currently nine universities and PARC (A xerox company) are working on the development of this new architecture and they named it as "NDN Project" [1].

While mounting the future internet architecture, there are many challenges which come on the way and remain in attention for the researchers like "Bandwidth, Mobility, Network Security, Network management, Routing Scalability, Fast Forwarding, Intelligent distribution of Information, Content protection and Privacy, Trust Models, Robustness and Efficiency, Performance Reliability and some more". So to cope up with these challenges different future internet architectures emerged under the umbrella of Information Centric Networking (ICN) like CCN, PRISP [9], 4WARD-NetInf [10], DONA, PURSUIT and SAIL and NDN (the new one) is also the part of this research chain. These all approaches differ from each other with respect to the specific architectures but they share some objectives, goals, few assumptions and also the structural architectural properties. Talking about them in general, the aim of all the above approaches is to develop well suited network architecture for the content distribution and the one suited to cope with the prevailing network challenges.

In the Named Data Networking (NDN), the packet which the consumer sends brings with it the data name rather than the addresses of the source or destination. This change of pattern points to a new data plane that is the consumer releases or sends out an interest packet (having the information of the required data) , reaches the router, which forwards it and then maintain itself as a form of pending Interest so that the data can be guided back to the consumer. The forwarding process in the NDN routers plays a vital role as it is able to detect the network issues by witnessing the data and interest packets two-way traffic and also exploring numerous substitute paths without loops.

In this paper the emphasis will be on elaborating NDN as a model which is well suited with the today's internet and has a very clear and simple development strategy.

The NDN project report by L.Zhang et al [1] drafted the blueprint of the general NDN concept and its architecture and stated that "NDN is a universal Overlay" same like IP. Anything can be run over it and it can run over anything including the IP. The IP services related to its infrastructure which had taken years to develop can be used by NDN. This is because the hierarchically developed structured names in NDN are easily compatible with the hierarchically developed structured address of the IP and the "BGP, OSPF and IS-IS", which are the core IP routing protocols can be readily used to deploy NDN, over and parallel with IP. So the NDN's benefits and advantages in the content distribution, user friendly communication, naming, high security, mobility and broadcast will be appreciated incrementally with the passage of time [1].

The paper is organized as follows. We discussed some of the existing internet architecture approaches in Section 2 and the overview the NDN data plane in Section 3. A brief overview of the NDN architecture, its architectural principles and a minor comparison between NDN and CDN is showed in section 4. Some of the major research issues and future internet architecture challenges are enlightened in Section 5. Efforts and notable work developments in this area are briefly described in Section 6 and lastly we conclude in Section 7.

2. OVERVIEW OF DIFFERENT INTERNET ARCHITECTURE APPROACHES

In this section there is a brief overview of some existing future Internet Architecture Approaches which includes: CCN (Content Centric Networking) [3], NetInf (Network of Information) [10], PRISP (the Public-Subscribe Internet Routing Paradigm) [9] and DONA (Data- Oriented Network Architecture).

2.1. Content-Centric Networking

The main concept behind CCN is that the request is generated by the consumer for the Information object (IO) which is then routed in the direction of that location in a network where that IO is been available. There are certain nodes that are traversed on the path which leads towards the producer. The nodes have caches which are checked during the move, being the probability of having the copies of the requested information by the consumer. The moment, the occurrence of IO is confirmed whether in cache memory of router or the producer IO, it is reverted back to the consumer or requester along the same path from where the request was originated. So on the way back, all the nodes, from where the information passes through, saves that information in there cache memory so that in case some other consumer wants the same information, so can find it from the cache of the nearby node. CCN is shown in fig 1.

2.2. Public Subscribe Internet Routing Paradigm

If talking about PRISP shown in fig 2, its concept is slightly different from the CCN's concept as in PRISP all the data or the Information Objects are circulated by the sources in to the network. So in accordance with that published IOs, the consumers can subscribe to it. The Rendezvous system then tallied the "Publications" and "Subscriptions". As a result of this matching practice, comes the Rendezvous Identifier (RI) which can comprehend as an identifier for the communication network. The RI then sequentially set on (within the range) to forwarding Identifier. The forwarding Identifier can be used for the data routing in the forwarding network.

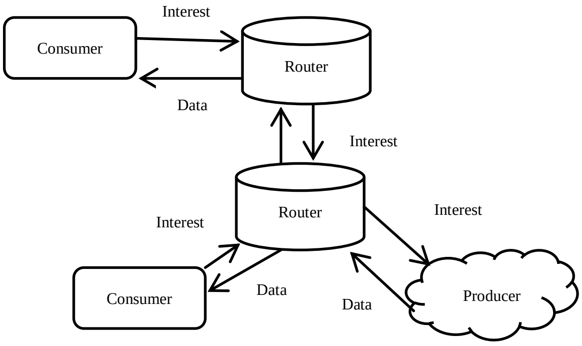

Figure 1. Content-Centric Networking

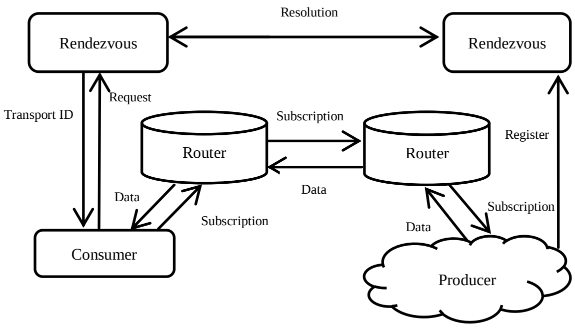

Figure 2. Public Subscribe Internet Routing Paradigm

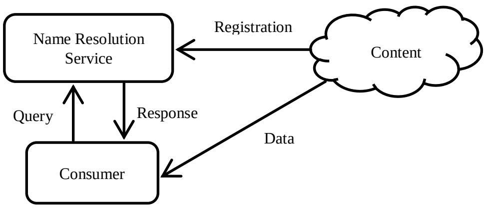

Figure 3. Network of Information

2.3. Network of Information

Like in PRISP, in the NetInf shown in fig 3, the IO's are also broadcasted into the network and which are enumerated with the NRS (Name Resolution service). Network Locators are used to recover the data objects (represents published IOs) and are registered by the help of NRS. When the consumer wants to retrieve the data, a request is generated and that is request is then classified by the NRS into group of locators. The further process is based on these locators because they are then consumed to recover the copy of the required data from the paramount source(s).

2.4. Data-Oriented Network Architecture

As mirror to PRISP and NetInf, in DONA also the IOs are broadcasted by the sources to the whole network. Nodes are legalized to serve as the data register to RI (Resolution Infrastructure). It is because when the content which is given got registered, the request can be easily moved to it. When this content registration expires, it definitely needs to be renewed because the Register commands possess the TTL phenomenon. In DONA there is Resolution Handlers (RH) which has a hierarchical based structure. So by using name in the hierarchical style, the request is routed. The RI tends to route the request by using name and also try to catch a copy or find the content nearest to the consumer. Fig 4(a) is showing IP based connection and fig 4(b) is showing the data oriented process.

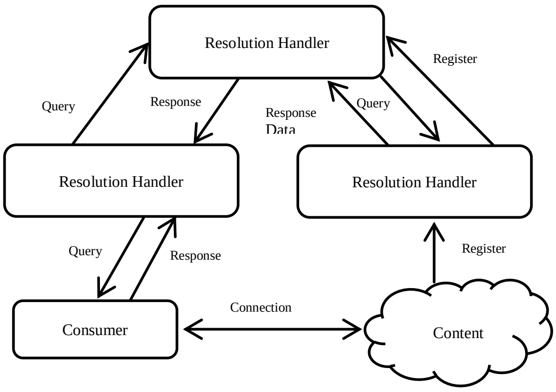

Figure 4(a). IP based connection

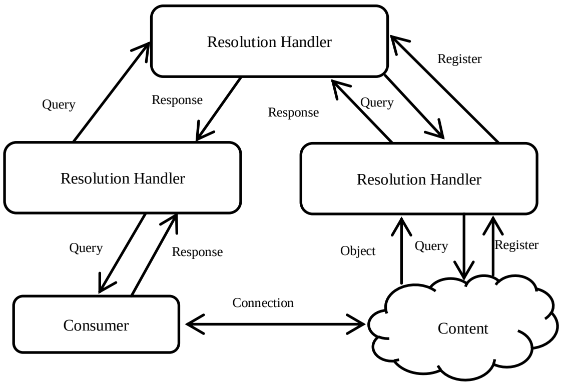

Figure 4(b). Entirely data oriented process

3. NDN Data Plan, A Brief Overview

This section is to introduce NDN briefly, focusing on its data plane. NDN is data-centric protocol for communication and is receiver based. The whole communication in NDN is done by using two different types of packets. We call them “Interest” and “Data”, both of them carries a name, which identifies the required data. What the consumer all have to do is to put the name of the required data into an interest packet and directs it to the network. Using the data name, the router forwards it to the data producer. After matching the name with the data, the data whose name best matches with the required one, is then sends back to the consumer. To tightly bind the name to the data, all the data packets carry a signature [15].

Like the IP packet delivery, “an NDN packet performs best effort data recovery” [2]. During processing the data or interest packet can be lost. So after the predictable RTT if the consumer does not receive the desired data then it is the responsibility of the end consumer to re-transmit the interest back to the network. But unlike the IP’s, data delivery approach which is location centric, the NDN packets instead of carrying the source and destination, carry the data names. These are very basic differences in design but these small differences leads to two profound changes in the processes. First, the consumers in NDN do not have the names neither have the addresses which to be used for the delivery of data packet. In its place the routers in NDN keep all the record of the incoming interfaces and use information from pending interest to bring the matched data back to the consumer. Second, even though the name present in the interest packet guides the forwarding process same like in IP packet in which the destination address guides the forwarding, the interest may find the copy of the requested data in a nearby router and bring the data back to the consumer while talking about IP packet, it goes and reaches the destination.

3.1. Forwarding Process

Each NDN router comprises of three major parts: First is the content store for caching of the required data, second is the Pending Interest Table (PIT) and third is the forwarding Table (FIB) (see Fig. 5).As cleared by its name, the job of PIT is to record each entry of the forward interest packet and also waiting for the return of the data packet. The entry has the record of three things, the name, the interface of the upcoming interest and the outgoing interface. The FIB in NDN is similar to the FIB in the IP router. The difference is just that in NDN, FIB contains the name prefixes whereas in IP router it has IP address prefixes [2].

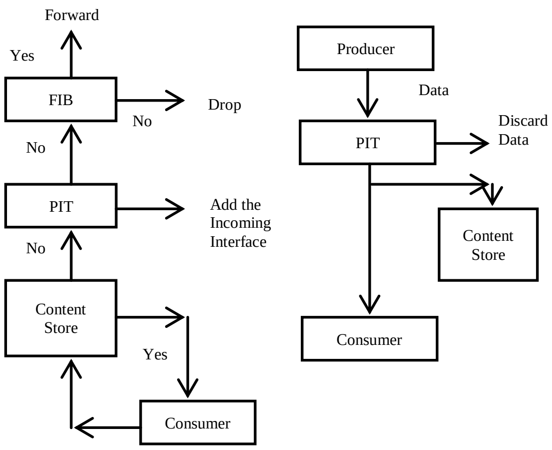

Figure 5. Forwarding process

Router has a content store so when it receives the Interest packet from the consumer, it first checks that whether there is matching data in its content store or not. If yes, then the data is extracted from that source and sent back on the same incoming interface. If no, then the interest goes to the PIT and in PIT interest is checked against the entries of it. If the entry is there already, so it means that some other consumer’s request had already been there for the same data and is forwarded earlier. The router then adds this new interest to the already present PIT entry. In other condition, if the name not exists in PIT, the interest is then put in to the PIT and forwarded ahead. The consumer also generates a “random nonce” which each interest packet also carries with the data name. When the interest is received at the router, the router remembers both the nonce and the name of each interest received, so that the router can tell whether the newly received interest packet is really a new one or it is the one which is looped back and drops it. Both interest packet and data packet do not loop because reverse path is followed by the data packets, corresponding to the interest packets.

When the data packet is arrived, the PIT is looked up using the data packet name. If the PIT has some more entries for the same data packet, then PIT sends the packet to all the interfaces from where those interests were received, also caches the data and finally remove this entry of PIT. Or else the data packet is unwanted one and discarded. Each interest in the PIT entry have a related life time, when this life time expires, the PIT entry is simply removed.

3.2. The Datagram State

When the router upholds an entry in its PIT for each pending interest packet, then it is said that the router holds the datagram state [2]. This datagram state directs to a two-way and a closed loop packet flow that is upon each link, every single interest packet draws back precisely one data packet keeping the flow balance except for few rare cases when sometimes the matching data does not exist or when the packets got lost.

4. ARCHITECTURE

NDN is totally a brand new architecture but the one whose actions can be substantiated in the recent practice. Its design glitters and elaborates in such a way to have good understanding of the strengths and weaknesses of the current Internet Architecture.

4.1. NDN Architectural Principles

The new internet design is made sophisticated and powerful by *"hourglass architecture"* because it hubs on a *universal* network layer (IP) applying the *marginal* functionality which is compulsory for worldwide interconnectivity. By permitting lesser and higher layer technologies to revolutionize without needless restraints, such alleged "thin waist" has been a key enabler of the Internet's volatile growth. The NDN also keeps the same architecture of "hourglass shape". Into the architecture, one thing must be built that is *security*. In the existing internet architecture, security is a second thought which is not in a position to meet the demand of progressively inimical environment. By validating all called data, NDN delivers an elementary security structure at the "thin waist". In the face of network failures, the progress of vigorous applications has been empowered by the *"end to end principle* [15]*".*

To unwavering network process, flow-balanced data distribution is vital. For that, it's essential that network transportation should be *self-regulating*. NDN plans balanced flow into the "thin waist". As IP executes open loop data transfer, so to deliver unicast balanced flow, transport protocols have been edited. The split-up of *routing and forwarding* [1] has been confirmed compulsory for internet improvement. By doing this, the forwarding plane functions rightly while the routing structure endures to evolve over time without any hurdle. So the same technique has been applied in the NDN, with the best accessible forwarding technology. "Architecture is not neutral" [18], it has been educated by worldwide distribution. So it's mean that architecture should be eased to user choice and competition but depends that where it can be possible. Indeed, NDN makes a conscious effort to fulfill the demanded facilities by users.

4.2. The NDN Architecture

Interest Packet

Content Name
Selector
Nonce

Data Packet

Content Name
Signature
Signed Info
Data

Figure 6. Data & Interest Packets

The fig. 6 [1] shows the structure of Data and Interest Packets and also what information they carry. In this section we will see in detail that how different elements of the NDN Architecture are playing there part to make this model the smart one.

4.2.1. Names

Names of NDN are unclear to the network means that the routers do not have any information about the meaning of the name although they have knowledge about the frontiers between components in a name. This gives a way to each application to choose the naming pattern and also permits the naming schemes to grow individually from the network.

Hierarchically structured names are adopted by the NDN design, e.g. information broadcasted by some company may have the name /work/update/info.pdf, where the sign '/' shows the border between name components but this sign is not included in the name. The hierarchical structure is beneficial to signify interaction among pieces of data e.g. some updated version of the same information can be named as /work/update/info.pdf/1/1. The hierarchy also permits the routing to mount while it may be possible to route on "flat names" [19]. It is totally necessary for common structures to permit the different programs to function upon the NDN names, can only be achieved by an agreement between the data producers and the consumers. It is not necessary for the names to be "*globally unique*" [1], but while retrieving the data some amount of global distinctiveness can be required.

Taking about it more generally, naming is the most vital and important part of the NDN Architecture so it is still under effective research. Another big challenge which is still open is that how to describe and assign the top level names. So in parallel with the research in designing and developing NDN architecture, the research on the name detection, name structure and also the navigation in the background of application development must be preceded.

4.2.2. Data-Centric Security

In "NDN", the concept of security is different as security is built into the data itself [5]. With its name, each portion of data is engaged together, tightly compulsory them.in the "NDN", the data names are compulsory so the requests cannot "opt out" [1] of the security. The name, united with records originator data, allows determination of records origin, letting the user's trust in information to be decoupled from how and from where data is found. There is a support for the "fine-grained trust" which allows the users to reason that whether a public important holder is suitable originator for a specific part of information in a particular background or not. Whenever, the era of practical approach comes, and then the "fine-grained and data-centric security" methodology needs some novelty. Traditionally, public crucial cryptography based on the security has been reflected incompetent, impracticable and problematic to deploy. To manage the customer's trust, the "NDN" needs elastic and practical devices indeed besides the effective digital names. In "NDN" key distribution is actually simplified because the keys can be lead into as "NDN" data.

"NDN's end-to-end approach" to security, enables confidence between originators and users. A great deal of flexibility in choosing or customizing their trust models has been offered, to the consumers, publishers and applications by the "NDN's end-to-end approach"[15]. "NDN's data-centric security" can be prolonged to the content admittance governor and structure security.as the applications can control the data access by encryption and allocate its keys as the encrypted NDN data, by restrictive the data safety border to the framework of a solo request.

4.2.3. Routing and Forwarding

There are four problems have been addressed in the current "IP" structure such as accessible report management, mobility, "NAT" traversal and the addressing of the space enervation. "NDN's routes and forwards" eradicates the above mentioned four problems of the "IP" structure. Routing can be done in the same way to today's "IP" routing [2]. A router proclaims title prefaces instead of proclaiming "IP" precedes that insure the data that the router is eager to serve. Through a routing protocol, this declaration is broadcasted. Based on received routing proclamations, each router builds its "FIB". Conservative protocols of routing, such as "OSPF" and "BGP", can be modified to route on name prefaces [1]. Routers deal with names as an order of impervious modules. They only do "component-wise" longest preface match of the "Content Name" from a pack against the "FIB".

For example, /work/update/info.pdf may compete both /work/update and / work in the "FIB". The reality based on it that supporting the multipath routing is inherited in "NDN". In "IP" routing, it accepts a sole best route to stop circles. The name and an accidental nonce can efficiently recognize duplicates to remove so it's mean that in "NDN" interest cannot loop importunately. Data do not circle since they take the opposite track of benefits. So by doing this, "NDN router" can refer out a concern by using the numerous borders without distressing about the loops. The 1st information coming back will satisfy the concern, and be accumulated locally. Later received duplicates will be rejected. In the "NDN" routing security mechanism has really been improved. 1st, containing routing posts, averts them from being deceived or meddled with. 2nd, multiple paths routing alleviates preface overthrow meanwhile routers can identify the irregularity triggered by precede takeover and effort to other ways to recover the data. 3rd, in fact, the "NDN" messages can exchange only about records. It merely cannot be spoken to multitudes sorts it is problematic to direct malevolent packages to a specific mark.

4.2.4. Caching

"Content stores" has been checked firstly by the "NDN router", while receiving an interest. The information will be sent back as a reply but condition is that if there is a data whose title comes under the concern's name. The "content store" is just the buffer memory in current's router [1]. The reality is as well that both the "IP" and "NDN" routers buffer the data packs. Difference comes in this way that "IP" routers cannot reclaim the record after sending them ahead. On the other hand, that the "NDN" routers can reuse the information since they are recognized by insistent titles. "NDN" can accept optimum data for the statistic records. Even vibrant content can advantage from "caching" in the situation of multiple cast for example teleconferencing or pack retransmission after a package loss. The privacy concerns can be raised in the caching named information. Currently the "IP" networking system has been offering the weak confidentiality defense. By examining the heading or the payload, one can discover what is in an "IP" package. By examining the endpoint address, one can search out that who demanded the data. "NDN" obviously titles the data, debatably creating it easier for a network display to see that what data is being invited, but it eliminates completely the data concerning who is re-demanding the data.

By ingenious searching systems to originate what is in the cache, one may also be able to acquire what information is re-demanding. But on the other hand, "NDN" eliminates completely the information concerning who is demanding the information. But for unswervingly linked to the demanding host by a “point-to-point link”, a router will only tell that someone has demanded definite data, but never recognize who created the appeal. Thus the “NDN” construction obviously proposals privacy defense at a basically dissimilar level than the existing architecture.

4.3. The NDN Sticks to its Architecture and Benefit the People

Today, applications have to depend on difficult middleware to map from IP’s host based generalizations to the gratified that they care about. NDN importantly make simpler application development and new applications in short will drive additional development and success of the future internet. It’s means that NDN rearranges the architecture with application by accepting so-called data as the “thin waist” of the hourglass architecture. The trustworthiness of the future Internet is also achieved through providing the essential building blocks by the NDN signed data. The personalized confirmation, approval, and trust models can be built by applications. NDN follows to the end-to-end code. Such mark of NDN data delivers both honesty defenses and data source genuineness, so that when the user obtains the data and confirms the signature, he recognizes for sure that he has acknowledged a copy of the original data issued by that creator. Thus NDN proposes a very strong idea of protected end-to-end data broadcast [15], even yet the producer and consumer do not connect in a straight line. Only a single path to each and every endpoint has been used by IP’s in the current global routing system. Such path is symmetric by “hot potato” routing [1]. In such scenario, it becomes difficult to quantifies and equate output through diverse service suppliers concurrently.

But with NDN’s multipath advancing ability and response loop, consumers can discover more than one path, monitor distribution shows, and make their selections. This will inspire novelties and savings into the network organization through struggle. One important societal impression of the Internet is distributing content and information because NDN democratizes contented delivery; indeed it is another characteristic of it to facilitate choice and competition for users. Definitely, on the other hand it will also have a helpful feedback consequence, inspiring people to produce original content.

4.4. Comparison of NDN and CDN

“Isn’t NDN another overlay/CDN/Search/pub-sub system?” this question is asked very often, as its true that NDN is an overlay in the identical logic that IP is an overlay on uppermost of all the dissimilar communication systems positioned today.

Today’s “content distribution networks” (CDNs) are fundamentally an enormous overlay arrangement, arraying a huge number of technologies to store and serve data [1]. The facility is costly, and precise to only contracted requests specifically altered to use it. Modest best-strength packet passage between NDN nodes just entails in this system. It can route on topmost of any “layer-2 technology” or overhead.

“CDNs” are fundamentally a substantial overlap infrastructure [5], establishing a large number of machines to supply and assistance contracted records. Services provided by the “CDNs” are really costly and specially linked to the contracted submissions. “CDN” are insulated from each other that is why enactment of each one is restricted by its own server exposure. There is the growing necessity of contented distribution because services for the extensive systems of “CDN” are organized by the big content makers. Consumers may acquire the application or data titles but in the form of amalgamation of memory, social groups of friends and family, estimating and search devices and after that they will use “NDN” to recover the parallel information from the whole system of network [2]. All “NDN” supply both Interests whether in “PIT” or in data packets, therefore no out of work notice is directed upstream over the similar pathways, and no out of a job data is lead to downstream. This is really in contrast to the existing publishing design system. So “NDN” comes with a struggle to overwhelm the limits of the “CDN” and customizes content circulation.

5. RESEARCH ISSUES

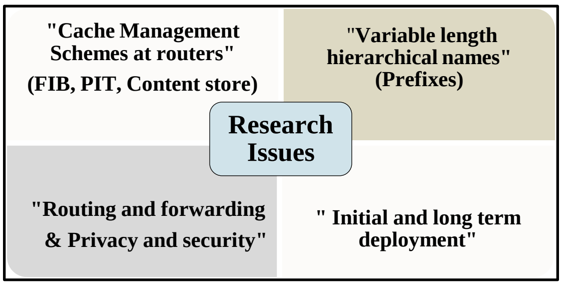

Figure 7. Major Research Issues

It is difficult for the researchers to focus on all the challenges which come in the architectural development. So the focus should be on the most critical (mentioned in figure 7) for understanding and testing the NDN design. We must come up with the best solutions to develop the scalable routing and the fast forwarding devices that can grip NDN traffic flow at wire speed so that to show NDN as a deployable structure globally. Another thing is that we must have to improve applications that run on the top of NDN both to push the growth of the design and to get the verification of the NDN viability and practicality in supporting the current applications and smoothing fresh generations of applications. We also have to must validate how the security fundamentals in NDN can be used well and proficiently to secure applications, safeguard privacy and secure the infrastructure itself. The new communication model of NDN not only deals with the transmission but also storage, which needs new essential theory of communication. These are the spots we must explore new assessment methodologies to scale the precision and efficiency in the NDN design.

6. RELATED WORK

Research is basically a chain process in which the previous work gives support to the new innovation. The NDN ideas, concepts and approaches also comes from the previous struggle which is done in relevant to the design of the internet architecture and these efforts have a clear picture if flash back to past 20 years and earlier. The earlier efforts includes the “Directed Diffusion Design”, “Adapting web caching project [13]”, “Design of scalable reliable multicast”, “RSVP [12]”, “Design of IP multicast routing [11]” and “TRAID project [14]”. In the past few years a lot a work is done and effort is putted in relevant to the development of the architectural designs of the data centric network and also very rich productive literature is been developed. Notably among those work developments are “Data Oriented Network Architecture” and the “Publish Subscribe Internet Routing Paradigm (PRISP) [9]”. Another one is 4WARD project [8] also termed as “4WARD-NetInf” is also a data-centric architecture which is developing but it mainly emphases on the upper level problems of the data exhibiting and abstraction. For data it uses the DONA-Style names and delivers publish style API. For securing (Like API), enhancing and improving the internet architecture and to make the architecture to provision Disruption tolerant networking, numerous design efforts are there and it can be possible to have more architectural design proposals in future.

7. CONCLUSION

Thinking about the advancements of the today’s world, the internet has a unique value among all the advancements of the current era. So internet is a enormous success and has changed the whole world dramatically and significantly. The internet architecture today is not a good match for this internet huge world and has some lope holes. So there should be such kind of new architecture design which can address the problems which comes in the network today and able to take it to the future with larger success than the current or past. The solution is easy, simplify the internet architecture design by just focusing on “What”(the content) rather than “Where”(the endpoint addresses).

In this paper we had given a brief overview of the new Internet architectural design called “Named Data Networking”, which is grounded on a very simple alteration. We had also sketched some overview of the existing future internet architecture approaches and then the new NDN architecture that identified the few research problems, which can be useful in developing and validating this new architecture. The core challenges include fast forwarding, Scalability (of routing on names), signatures efficiency, trust models (for data centric security), privacy and protection (of content), network security, and major communication theory which can integrate the memory as an essential portion of the communication model. The more research effort will be now on the advancement of the named-data approach for coping up with the internet’s more persistent problems in “Security, scalability, sustainability and stewardship”.

ACKNOWLEDGEMENTS

The authors are thankful to all.

REFERENCES

[1] L. Zhang et al. *Named Data Networking (NDN) Project.* Technical Report NDN-0001, PARC, October 30, 2010.
[2] C. Yi, A. Afanasyev, L. Wang, B. Zhang, L.Zhang. Adaptive forwarding in Named Data Networking. *In ACM SIGCOMM computer communication review*, volume 42, July 2012.
[3] A.Carzaniga, M. Papalini, L.Wolf. Content–Based Publish/ Subscribe Networking and Information-Centric Networking. *ICN’11,* August 19, 2011, Toronto, Ontario, Canada.
[4] Ghodsi, T. Koponen, J. Rajahalme, P. Sarolahti, S. Shenker. Naming in Content-Oriented Architecture, *SIGCOMM ICN’11*, August 19, 2011, Toronto, Ontario, Canada.
[5] V. Jacobson, D. K. Smetters, J. D. Thornton, M. F. Plass, N. H. Briggs, and R. L. Braynard. Networking named content. *In Proceedings of ACM CoNEXT*, 2009.

[6] Y. Wang, K. He, H. Dai, W. Meng, J. Jiang, B. Lui, and Y. Chen. Scalable name lookup in NDN using effective name component encoding. *In Proceedings of IEEE ICDCS*,2012

[7] P. Jokela, A. Zahemszky, C. E. Rothenberg, S. Arianfar, and P. Nikander, "LIPSIN: Line Speed Publish/Subscribe Inter-networking*", In Proceedings of the ACM SIGCOMM, 2009 conference on Data communication.New York*, NY, USA: ACM, 2009

[8] Ahlgren, M. D'Ambrosio, C. Dannewitz, A. Eriksson, J. Goli_c,D. Horne, A. Lindgren, O. Mammela, M. Marchisio, J. Makela, S. Nechifor, B. Ohlman, K. Pentikousis, S. Randriamasy, T. Rautio, E. Renault, P. Seittenranta, O. Strandberg, B. Tarnauca, V. Vercellone, and D. Zeghlache, *"Second NetInf architecture description," 4WARD EU FP7 Project*, v2.0, Apr. 2010.

[9] The psirp project. http//www.prisp.org/publication

[10] The fp7 4ward project. http://www.4ward-project.eu/.

[11] Steve Deering and David Cheriton. Muticast routing in internetworks and extended LANS. *In Proceedings of SIGCOMM* 1998.

[12] L.Zhang, S.Deering, D. Estrin, S. Shenker and D. Zappala. Rvsp: A new resource reservation protocol. *In IEEE Network,* September, 1993.

[13] S. Michel, K. Nguyen, A. Rosenstein, L.Zhang, S. Floyd and V. Jacobson. Adaptive web caching towards a new global caching architecture. *In Computer Networks & ISDN Systems,* November 1998.

[14] Mark Gritter and David Cheriton. An architecture for content routing support in the internet. *In USENIX Symposium on Internet Technologies and Systems,* 2001. J. Saltzer, D. Reed,and D.Clark. End to End arguments in system design.

[15] Y. Cheng et al. Smart forwarding: A case for stateful data plane. *Technical Report NDN-0002*, May 2012.

[16] Y. Wang, K. He, H. Dai, W. Meng, J. Jiang, B. Lui and Y. Chen. Scalable name lookup in NDN using effective name component encoding. *In Proceedings of IEEE ICDCS,* 2012.

[17] B. Ahlgren, C. Dannewitz, C. Imbrenda, D. Kutscher and B. Ohlman. A survey of Information-Centric Networking (Draft). *number 10492 in Dagstuhl*, Germany, 2011.

[18] David D. Clark, John Wroclawski, Karen R. sollins and Robert Braden. Tussle in cyberspace: defining tomorrow's internet. *In SIGCOMM '02: Proceedings of the 2002 conference on Applications, technologies, architectures and protocols for computer communications*, pages 347-356, New York, NY, USA, 2002. ACM.

[19] M. Caesar, T. Condie, J. Kannan, K. Lakshminarayanan, I. Stoica and S. Shenker. ROFL: routing on flat labels. *In ACM SIGCOMM*, page 374, 2006.

BIOGRAPHY OF AUTHORS

Zain ul Abidin Jaffri was born in Pakistan on Mar 01, 1988. He received his bachelor degree in electronics engineering from COMSATS Institute of Information Technology Abbottabad, Pakistan in 2010. Later on, he came to Chongqing University China for master's degree in electronics & communication engineering in 2012. He worked on control systems with focus on Model Predictive Control (MPC) Systems in past and is now working on Advance Computer Networks and Wireless Sensor Networks in Chongqing University China. Mr. Jaffri has been awarded Chinese Government Scholarship for his master degree in Chongqing University in 2012.

Zeeshan Ahmad was born in Pakistan on Apr. 02, 1988. He received his bachelor degree in electrical engineering with specialization in communication engineering from Bahria University Islamabad, Pakistan in 2010. Later on, he came to Chongqing University China for master's degree in communication engineering in 2012. From 2010 to 2011 he worked in telecom sector on different Positions. He published his thesis in form of a book with Lambert Academic Publishing in Jun. 30, 2011, titled as Remote Monitoring System. He worked on High Frequency in past and is working on Array Signal Processing nowadays in Chongqing University China.
Mr. Ahmad got 1st position in secondary school certificate examination in school and has been awarded the Chinese government scholarship for his master degree in Chongqing University in 2012.

Muhammad Tahir was born in Pakistan on July 09, 1987. He received his bachelor degree in software engineering from University of Sindh, Jamshoro, Pakistan in 2009. Later on, he came to Chongqing University China for master's degree in software engineering in 2012.
He worked in software industry on different positions from 2010 to 2011 His field of interests are Software Architecture, Big Data, Network Information Security, Cloud Computing, Semantic Web, Data Mining, Software Engineering in Medical.