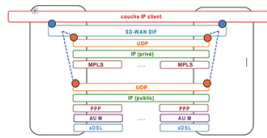




**RINA
SMOOTH TRANSITION
& RAPID ROLLOUT
P.2-3**



**THE KEY BENEFITS OF
RINA
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RINA

RECURSIVE INTERNETWORK ARCHITECTURE



The idea of transmitting information by splitting it into data packets with a destination address was born in the 1970s. This protocol, the datagram, resulting from the work of the Cyclades team led by Louis Pouzin, has remained unchanged since **1971**. After the withdrawal of the Cyclades project by the French government, this datagram principle was adopted in **1974** by the Americans who simplified the protocol to publish a version of TCP/IP in 1983. **Although the Internet network has grown rapidly, the physical limitations of the TCP/IP protocol were known as early as 1983.**

Deployed worldwide, connecting more than 4 billion people, the simplistic design of the TCP/IP protocol has enabled the rapid development of the Internet. Today, new applications such as the Internet of Things and mobility or new challenges such as cybercrime and cyberwar are holding back its future growth.

Based on the datagram protocol, John Day (a former ARPANET member) describes a rational network architecture in his book *Patterns in network architecture: a return to fundamentals* (2008). The European Commission has funded several projects to develop a Recursive InterNetwork Architecture (RINA) on this work, the results of which are now available (Github).

RINA solves the main problems encountered in today's Internet architecture in terms of security, scalability, performance, manageability, flexibility, reliability, mobility and cost.

RINA has been recognized by the global European standards ETSI as a *Next Generation Protocols (NGP); An example of a non-IP network protocol architecture based on RINA design principles* (2019).

OTHER RESEARCH AREAS

Since 2000, research programmes have been devoted to **New Network Architectures** to solve the gaps in the current Internet.

In **USA**, **Named Data Networking** (NDN), whose model focuses on content, the **GENIE** project and **MobilityFirst**, focused on mobile services and funded by the National Science Foundation (NSF).

In **Europe**, the **4WARD** project was expected to create a network architecture where information is independent of its hosting location.

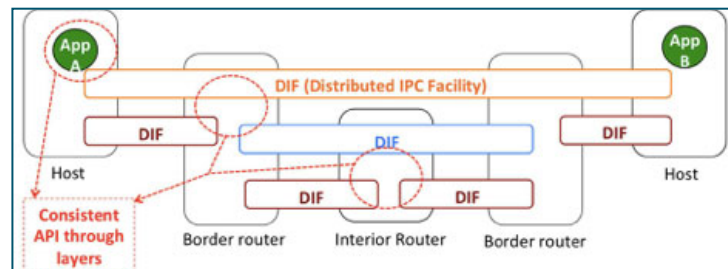
These programmes have all remained at the project level.



RINA is a new network architecture to unite distributed computing and telecommunications.

RINA, outlined in 2008

In 2008, ARPANET pioneer John Day published a book: *Patterns in network architecture: a return to fundamentals*. He proposes an alternative to TCP/IP based on the datagram of the Cyclades project: he calls this new architecture, **RINA**.



The structure of RINA is based on a repetitive layer named DIF, (Distributed IPC Facility)

Efficient addressing

In TCP/IP, addresses are assigned to interfaces and not to nodes. This makes multi-homing impossible to support because the network does not know that two interface addresses can reach the same node. It also makes router routing tables 3 to 4 times larger and complicates mobility.

A unique layer

The specificity of RINA is to be built on a single layer type, which is repeated as many times as necessary by the network designer.

This is the DIF

(Distributed IPC Facility).

A distributed application that provides Inter Process Communication (IPC).

These two terms - DIF and IPC - are the semantic foundations of RINA.

RINA, Louis Pouzin's crusade, one of the fathers of Internet



Inventor of the **Shell** language and the basic protocol of the Internet, the **datagram**, he has been pointing out the lack of security and instability of TCP/IP for many years.

John Day has adopted in RINA the fundamentals of the Cyclades project, abandoned in 1974 by the French government in favor of *Minitel*. The USA opted for datagrams for their networks in 1977.

Since 2017 Louis Pouzin has been on the move around the world to promote the new RINA architecture.

RINA in Europe

Over 300 researchers are working worldwide to develop RINA. The main places are in Spain (i2cat, University of Barcelona), Ireland (TSSG Laboratory, Dublin), USA (Boston University) and Norway (Oslo University).

From fundamental research to industrial experiments, RINA is at the heart of tomorrow's Internet developments.

Armenia chooses RINA

In October 2018, Armenia decided to switch its infrastructure to RINA and create a university training programme open to the whole world. It is the first country to have made this choice.

The RINArmenia project is being implemented in Yerevan:

- A team of computer engineers develops RINA protocols;
- A university training programme dedicated to RINA begins in January 2020 in Yerevan.



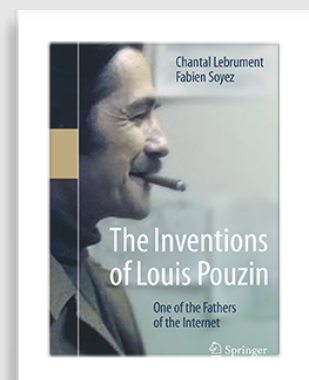
Do you want to test RINA?
The **RLITE** project is in Open Source for your developers

The RLITE code is in C/C++, adaptable also for Python, and is available on the **GitHub** website for developers:

```
[ 3712.511159] [DBG]dif_get: DIF rinawlangud.DIF [t
[ 3712.511161] [DBG]rl_shim_eth_create: New IPC cre
[ 3712.511162] [INF]rl_lpcp_create: IPC process 0 c
[ 3712.511259] [INF]rl_lpcp_wipep_set: IPC process
[ 3712.512357] [DBG]rl_shim_eth_config: netdev set
[ 3712.512358] [INF]rl_lpcp_config: Configured IPC
[ 3712.648981] brcmfmac: brcmf_inetaddr_changed: fa
[ 3714.516741] [DBG]dif_get: DIF n.DIF [ttype 'norma
```

To discover Internet & networks history :

« *The inventions of Louis Pouzin* »



Fabien Soye
Chantal Lebrument
(Springer - January 2020)

In 1972, Bob Metcalfe (Ethernet inventor) said: *"the fundamental function of the network is to ensure communication between processes, and only that"*.

Next Generation Network

In 1995, ITU launched a work project on NGN networks to meet the "Quality of Service" (QoS) needs for its telephony operators' customers.

The aim was to replace the switched telephone network with a packet-mode network architecture.

But, for ITU, an NGN network must meet certain conditions, including being able to exploit IP technologies, **while being able to ensure end-to-end** Quality of Service, both on **fixed and mobile networks**.

RINA, a reliable and resilient architecture

The main use cases of RINA are private or public networks, Internet of Things networks and highly secure client-server applications. The interface between a RINA zone and the rest of the TCP/IP Internet can be done through roots like the one provided by Open-Root.

SECURITY

RINA's infrastructure is impermeable to attacks from outside, unlike those on the TCP/IP network where IP addresses are public, while **in RINA they are secure containers**. Most of your firewalls, session controllers and intrusion protection systems are gone. No need to scan ports, even less risk of attacks.

SIMPLICITY

The type of communication desired is chosen: **Best Effort** or **Quality of Services**, when creating the communication channel between processes.

Inter-process communication is a unique and simplified network model through which any type of communication becomes possible, without having to use specialized protocols, unlike the current architecture of the Internet.

« Complexity is the first enemy of security » (Louis Pouzin)

MOBILITY

For TCP/IP to be able to manage mobility, it would require application names that do not change as the mobile host moves with addresses that change as the host moves.

In RINA, network designers can define freely the number and scope of DIFs in the network.

RELIABILITY

Multi-hosting goes from complex to simple. Reliability becomes a matter of course, easy to guarantee.

FLEXIBILITY

You can implement any [quality of service] principle within the architecture, not just the "Best of Effort", and create a customized system to allocate resources according to your priorities.

SCALABILITY

The recursive structure is spread indefinitely. No more exploding the size of the routing table.

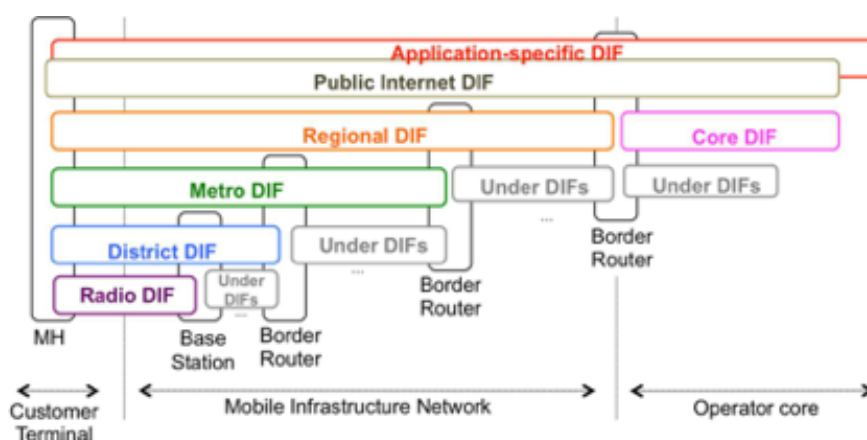
PERFORMANCE

Better monitoring of resources and sharing of information between processes.

COSTS

No more updates, server and bandwidth savings, flexible virtual architecture for reconfiguration as needed.

« RINA est une nouvelle architecture de réseau destinée à unifier l'informatique distribuée et les télécommunications » (ETSI)



In RINA, network designers can freely decide on the number and scope of DIFs in the network.

In February 2019, the European certification authority ETSI studied RINA



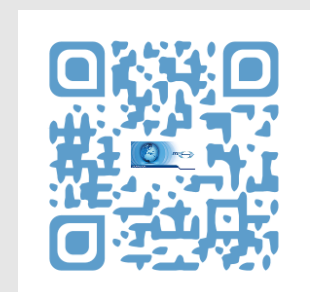
« RINA solves problems that are generic to a network (e. g. structure, naming and addressing, security models or QoS) at the architecture level »

www.etsi.org

A very complete 66-page report, graphs, a glossary and a list of abbreviations...

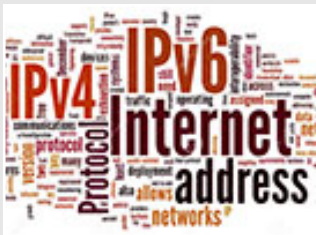
RINA, the future for European networks

Download the ETSI report by clicking on the QRCode below



IPv4 → IPv6

The IPv4 version of the IP protocol was validated in 1981. Since 1990, the IETF has wanted to make it more efficient. The IPv6 version was released in 1998 and standardized in 2017.



V6 stronger V4?

Based on the same principles as the v4 protocol, addressing in v6 is even more time-consuming when using routing tables. But more important, IPv6 does not support mobility or multi-hosting.

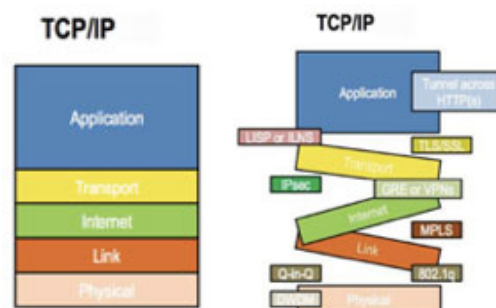
IETF RFC 6275: "Mobility support in IPv6", July 2011



Transmission Control Protocol/Internet Protocol (TCP/IP)

Why TCP/IP has problems

Network architectures are mainly based on the functional layer paradigm, which each performs different functions executed by different protocols, but designed independently of each other. These protocols have evolved without any organization to resolve individual use cases as they appeared, invalidating the original architectural model and increasing network complexity.



In TCP/IP the functions of the different layers are not independent

40 years later and more than 4.5 billion users....

The Internet compared to 1983 is: High-speed broadband, voice & television over IP, mobility, Internet of things...

The TCP/IP protocol was not designed to support such a diversity of applications

TCP/IP manages a data transport network through interfaces

RINA manages communication between programs through a network.



Initiated by Boston University, the PSOC website is the focal point for all developments and initiatives on RINA.

The objective of PSOC is to provide a forum to develop valid solutions to the current crisis in Internet architecture. Membership is open to qualified members of the network, both academic and industrial.

Through meetings, collaboration and publications, we seek to guide the rise of Recursive Inter-network Architecture (RINA), which will meet the needs of users for decades to come.

Jointly managed by the Barcelona i2Cat laboratory and the Boston University team, this site focuses the state of research on RINA.

Contact: info@pouzinsociety.org
Site: <http://pouzinsociety.org>

RINA Workshop

An annual meeting is held in Paris as part of the ICIN meeting at the end of February. It is then all researchers who meet and present their progress in the new Internet.



ICIN 2019, Paris - Louis Pouzin et John Day (center)

RINA Terminology

<http://pouzinsociety.org/education/terminology>

Some research programs on RINA



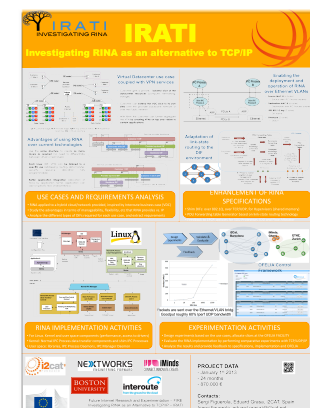
<http://ict-arcfire.eu>



<http://www.irati.eu/>



<http://ict-pristine.eu/>



IRATI Poster

RINA's advantages



Mobility management without dedicated protocols (5/6G)



Efficient security at a lower cost



Better network management



Recursivity: stop to design and code protocols from scratch



Quality of service and good use of resources (bandwidth savings)



Search for applications in different networks



Amazing speed tests:
more than 1000 times faster than TCP/IP

MORE

FOLLOW THE LATEST NEWS ON RINA

[HTTP://POUZINSOCIETY.ORG/](http://POUZINSOCIETY.ORG/)

RINA WORKSHOP 2019

[HTTP://POUZINSOCIETY.ORG/NODE/76](http://POUZINSOCIETY.ORG/NODE/76)

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NEXT

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