
# ICSNC/INNOV Panel on

# Trusted and Scalable Systems and Services: Challenges


# Trusted and Scalable Systems and Services: Challenges

- Panelists:
  - Eugen Borcoci, University Politehnica  Bucharest, Romania
  - Sung-Soon Park, Anyang University/Gluesys, Republic of Korea
  - Marta Piekarska, Blockstream Inc.
  - Burjiz Pithawala, Huawei Technologies, USA
- Moderator:
  - Jorge A. Cobb, U. Texas at Dallas, USA


Prof. Eugene Borcoci
University Politehnica Bucharest, Romania

# Scalability issues in new technologies - SDN and NFV


Professor Sung-Soon Park
Anyang University, Dept of CSE
Founder, CEO, and President Gluesys Co. Ltd.

# SSD based technology for High Performance Storage Area Networks


Dr. Marta Piekarska

Blockstream Inc.

# Fast Transactions on a Block Chain


Burjiz Pithawala
Huawei Technologies, USA

# Application Demands that Dictate scale for Cloud and Edge computing

# Prof. Eugene Borcoci

## University Politehnica  Bucharest, Romania

Dr. Eugen Borcoci is professor at University Politehnica of Bucharest (UPB) in the Telecommunications Department. His teaching and research have been oriented to specific domains of telecommunications and computer networks architectures technologies and services like:  communication protocols  and signaling systems,  quality of services assurance and management over multiple domains networks,  multicast and multimedia services over IP networks and heterogeneous access.

(continued) . . .

Recently, his research interests and activities are on new architectural approaches like Content Aware Networking, Cloud computing and 5G,  Information Centric Networking, Software Defined Networking (SDN), Network function virtualization (NFV).

Dr. Borcoci is a IARIA fellow


# Professor Sung-Soon Park

Dr. Sung-Soon Park is a Professor in the Department of CSE at Anyang University.

Major Research interest areas are

- Parallel File Systems
- Storage System Software
- Cloud Computing

He is also the  Founder, CEO, and President Gluesys Co. Lt, which is the leading NAS company in Korea.

Gluesys has expanded beyond the domestic market into foreign markets such as Singapore, Malaysia, and Vietnam with its corporate NAS solutions and shipped its personal NAS solutions to the USA, Europe, and Japan,


# Dr. Marta Piekarska

Dr. Marta Piekarska received her Doctor of Philosophy degree in Computer Science from the Technical University of Berlin

She is a Security Engineer, Privacy Expert, and Technical Manager

She was Chief Engineer in Mobile Privacy at T-Labs, Telekom Innovation Laboratories

She is currently with Blockstream Inc., which was founded to develop new ways to accelerate innovation in crypto currencies, open assets and smart contracts

# Burjiz Pithawala

is a recognized technology and business leader in IP Network Systems & Technologies. Burjiz has built many embedded system networking products from hardware to software and has been at the forefront of developing many of the Internet routing and switching protocols that are deployed in the current Internet.

As VP/CTO of Huawei Systems, Burjiz's interests include leading the architecture and development of the next generation Internet that facilitates a new set of demanding applications like Augmented/Virtual Reality (AR/VR), Fog/Edge Computing, IoT analytics and 5G Mobility.

# Security & Trust Challenges in Large Scale Networks

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August 2016

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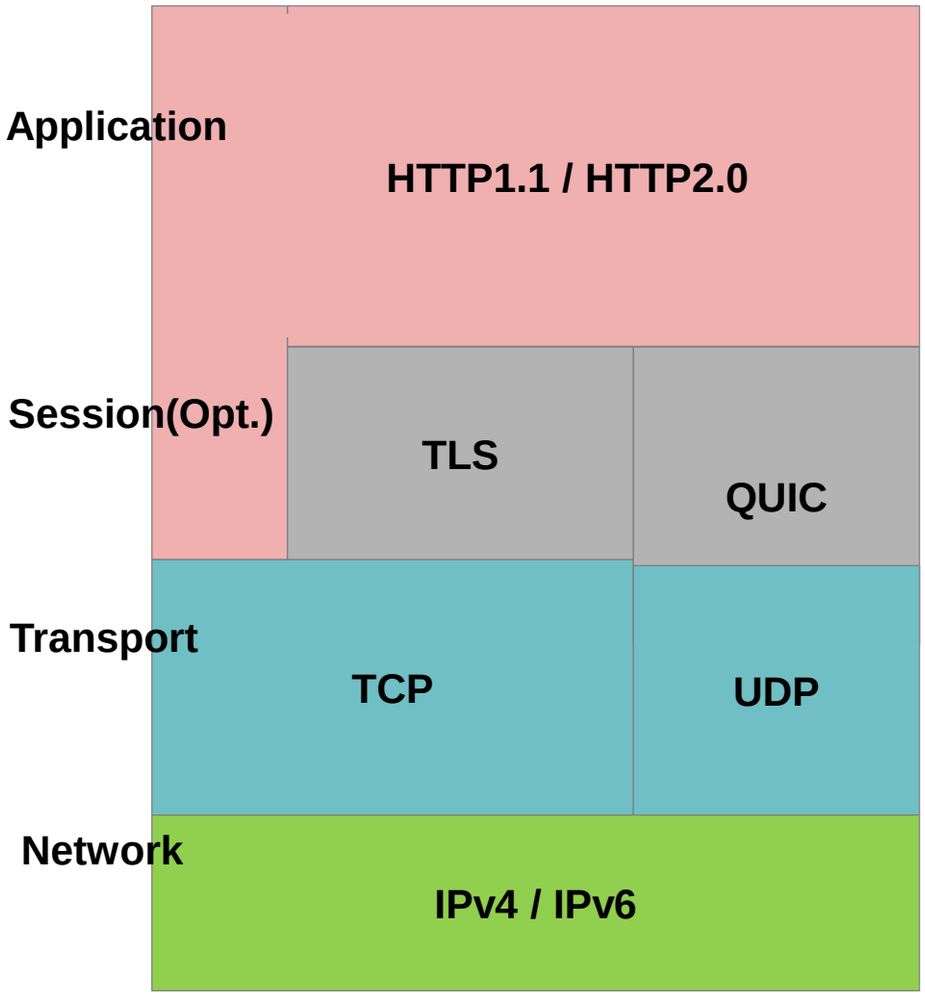
# Security should be built as part of Network DNA




**Security is more than encryption. It should prevent**

- **Malicious users**
- **Malicious traffic flows**
- **Route hijacks**

# Security Paradigm Today

- **Virtualization has removed the need for only Perimeter Security**
- **Zero Trust Security Concept in deployment today at low to medium scale**
  - Security enforced at all layers of machine, app, virtualization across systems within a domain
- **Lockheed-Martin Cyber Kill Cycle deployed with Zero Trust in most Cloud networks**
  - This included Micro-segmentation as preached by Vmware.
  - Concept is great but implementation is slow for large scale systems.
- **Key Management is still an Enterprise responsibility**
  - Need Cloud scale management from a cloud systems (AWS starting to provide it now).

# Security Challenges for 2020

- **Large (very) scale systems**
  - Grid, Medical, IoT are creating really large databases
  - Developing High Availability and Security systems needed
  - Most systems depend on some form of COTS but HA is missing in most OpenSource systems. Hence HA becomes proprietary.
  - Zero Trust Concept difficult to implement in large (east-west) traffic systems. Hence new models of Zero (or nearly Zero) Trust need development
- **Traffic Visibility**
  - 80% Traffic is going to be encrypted
  - Balance between privacy v/s information for most companies and countries
  - **New Traffic Visibility (Heuristic) Apps for determining traffic mix**

# Security Challenges for 2020

- **Large Scale Security Policy enforcement**
  - Firewall policies too complex
  - Virtualization demands detailed app/user policy at every lateral boundary
  - Balance between software implementation and hardware acceleration
  - Microsegmentation in Virtual Switches (NSX, OVS, FDD) not scaling to large scale of apps and users
  - **Policy definition using ID – should scale better than IP addresses/sockets**
  - **Policy enforcement using ID in Virtual Switch with some hardware acceleration should be the way forward.**
- **Cloud scale Key Management system**
  - IoT is part of this scale challenge
  - Key rotation adds to the issue

# Security Challenges for 2020

- **Cloud scale Key Management system**
  - Key Creation + Key Distribution + Key Storage at cloud scale is a massive problem today
  - Some companies trying different solution (AWS, Covata, Centri etc)
- **Data Center Security Architecture**
  - New paradigms needed for east-west security architecture
  - New paradigm needed for public-private (hybrid) operation for Enterprise

# Thank you

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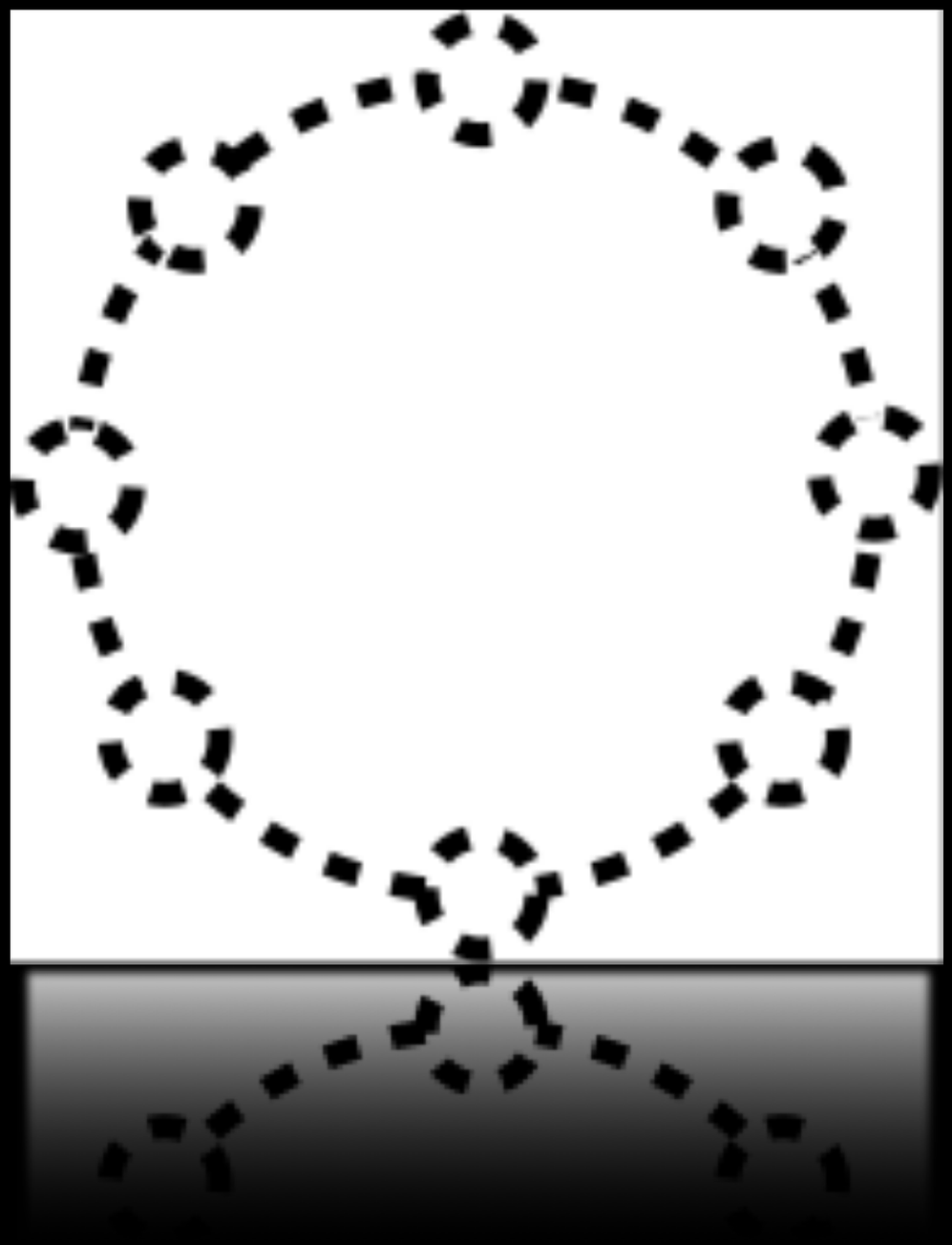
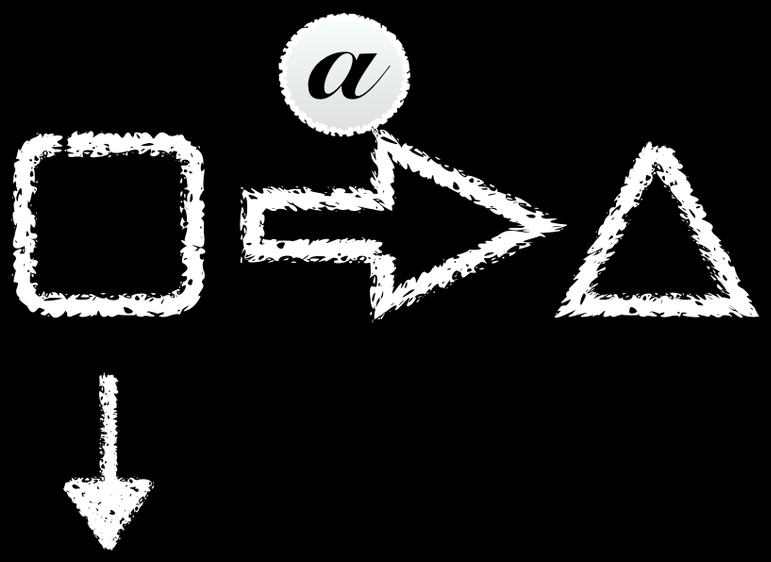
# FAST TRANSACTIONS ON A BLOCKCHAIN



# IT IS IMPOSSIBLE.

# Why?

# Why?



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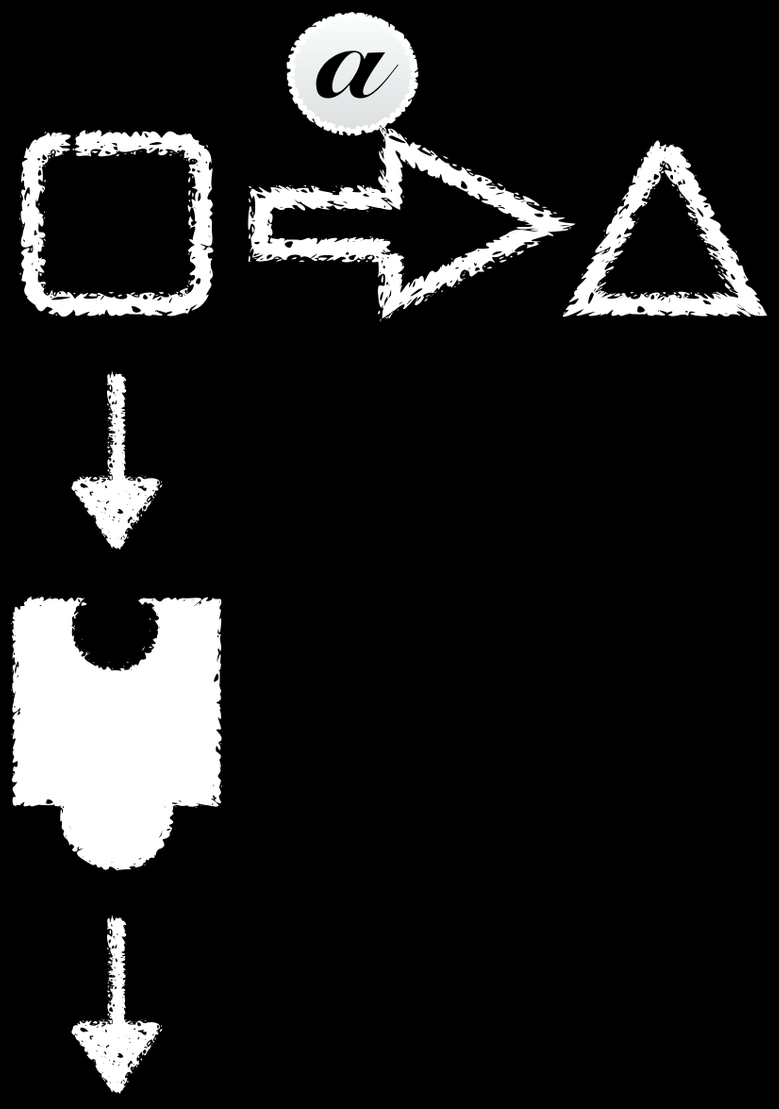

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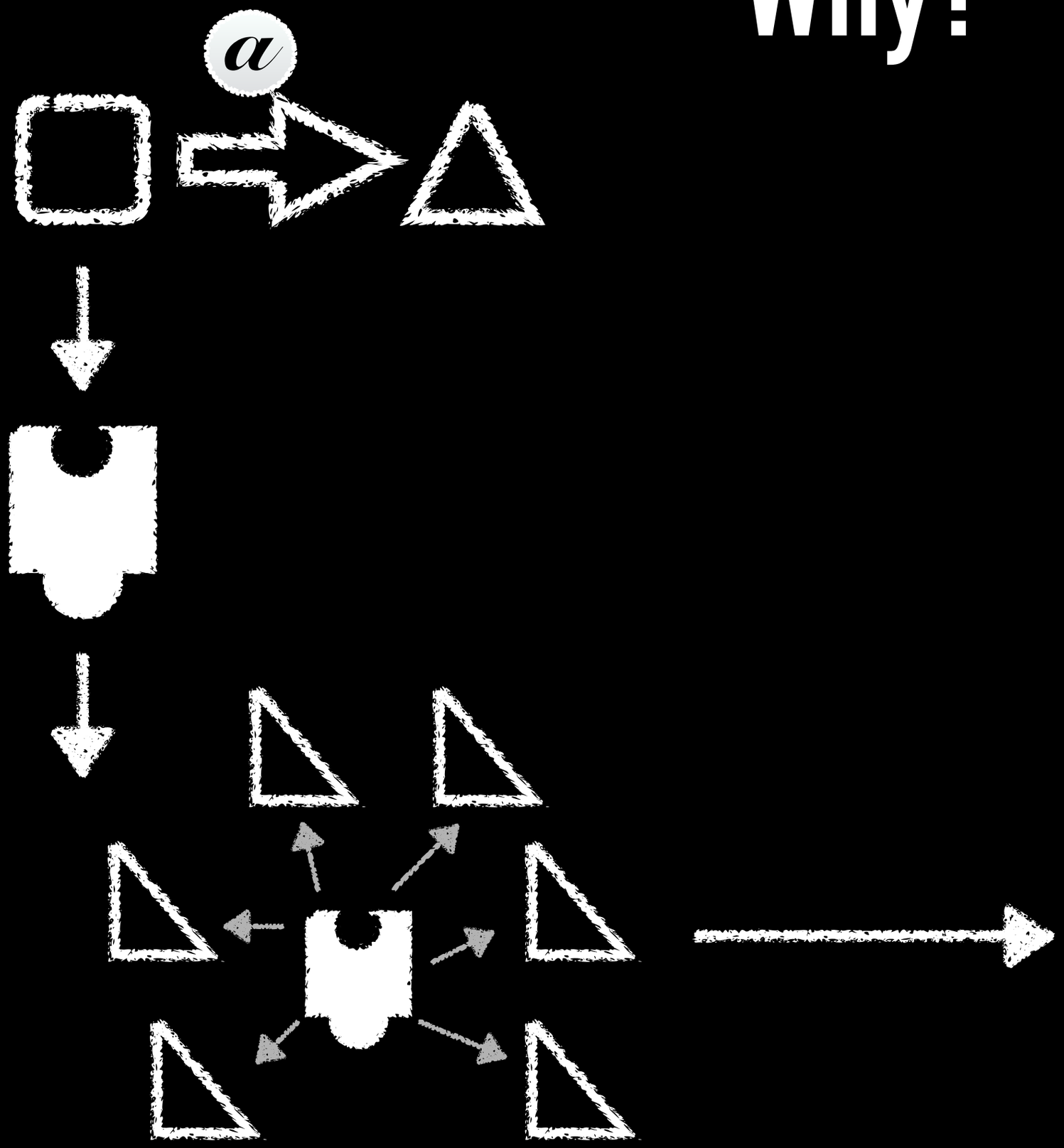

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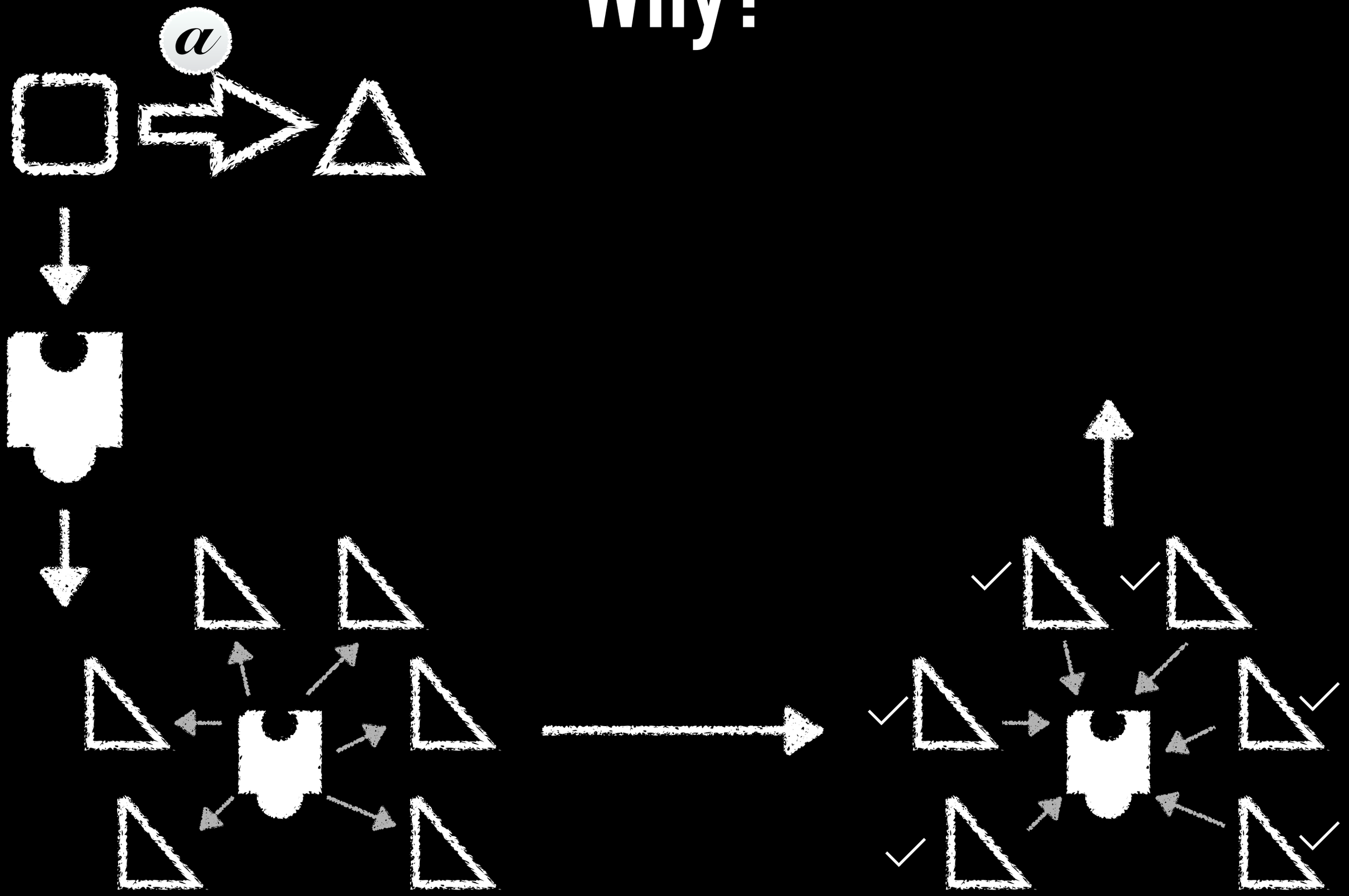

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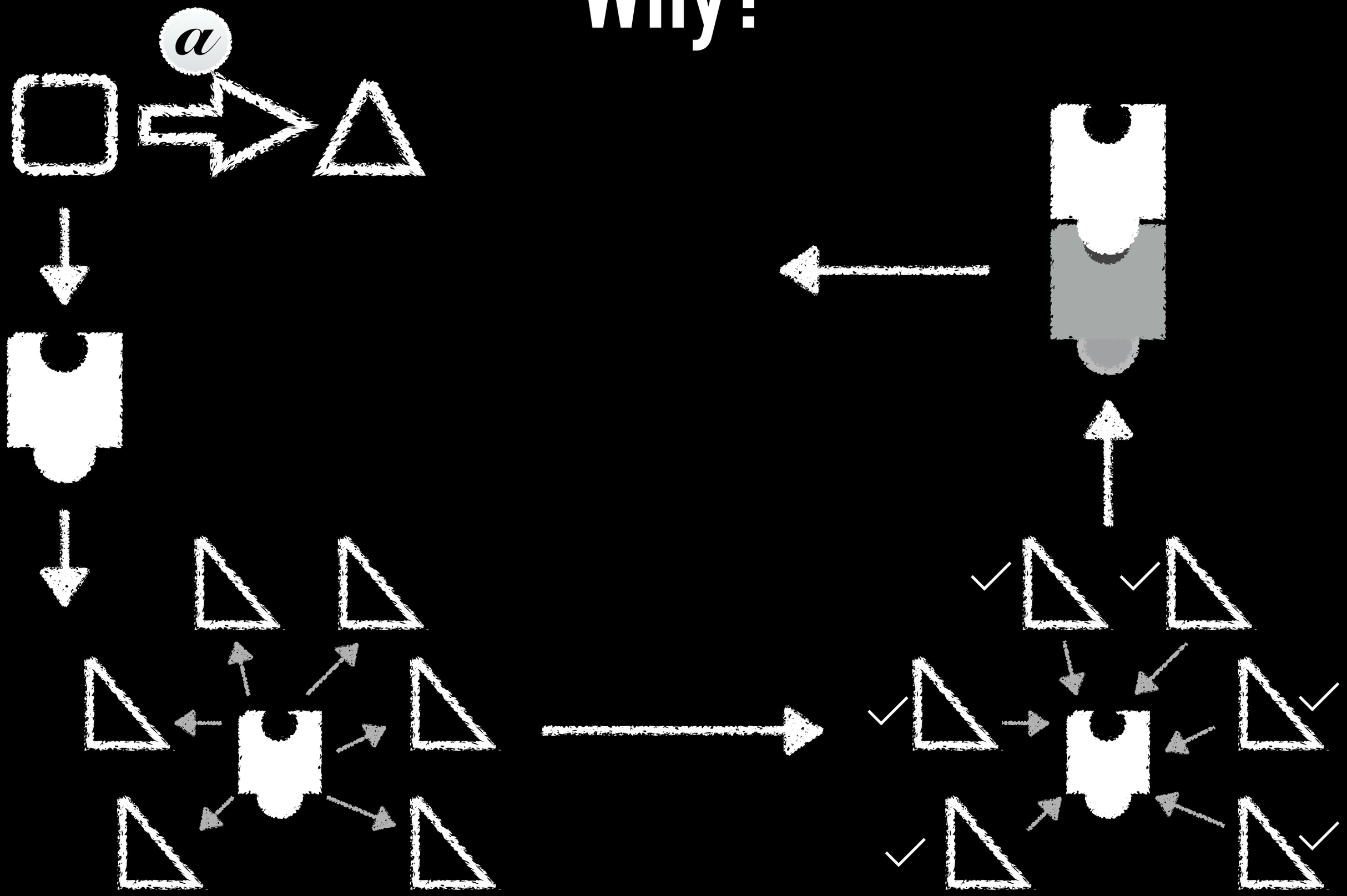

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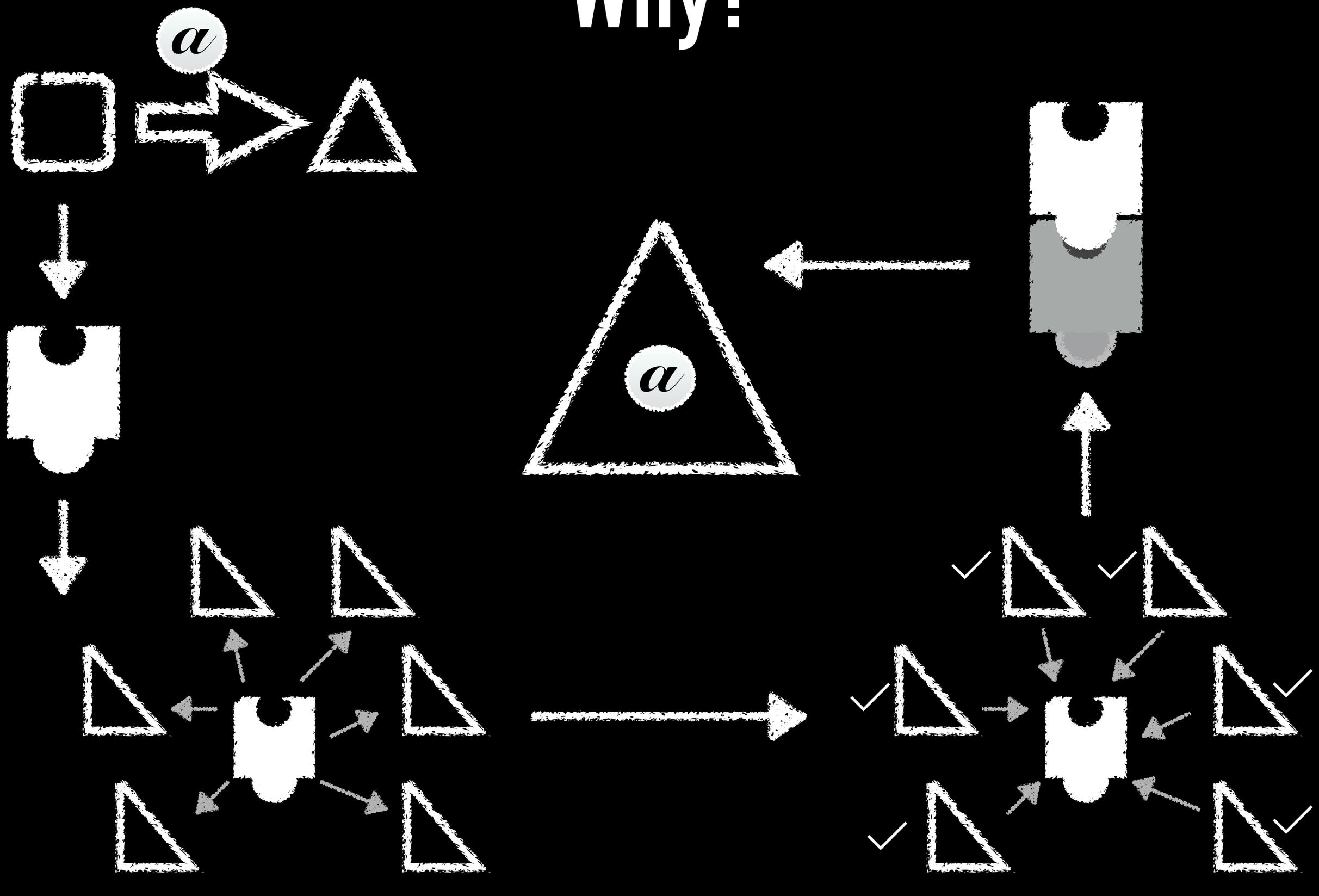

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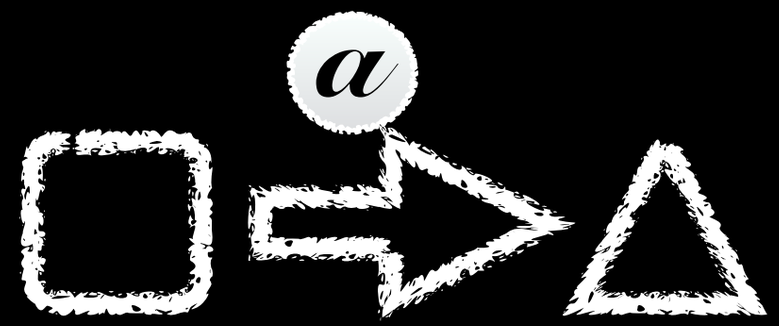
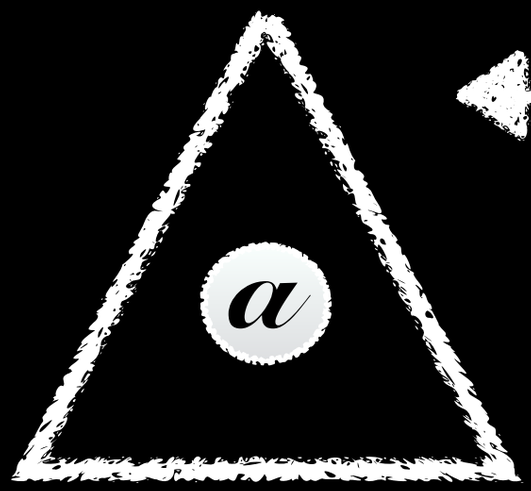
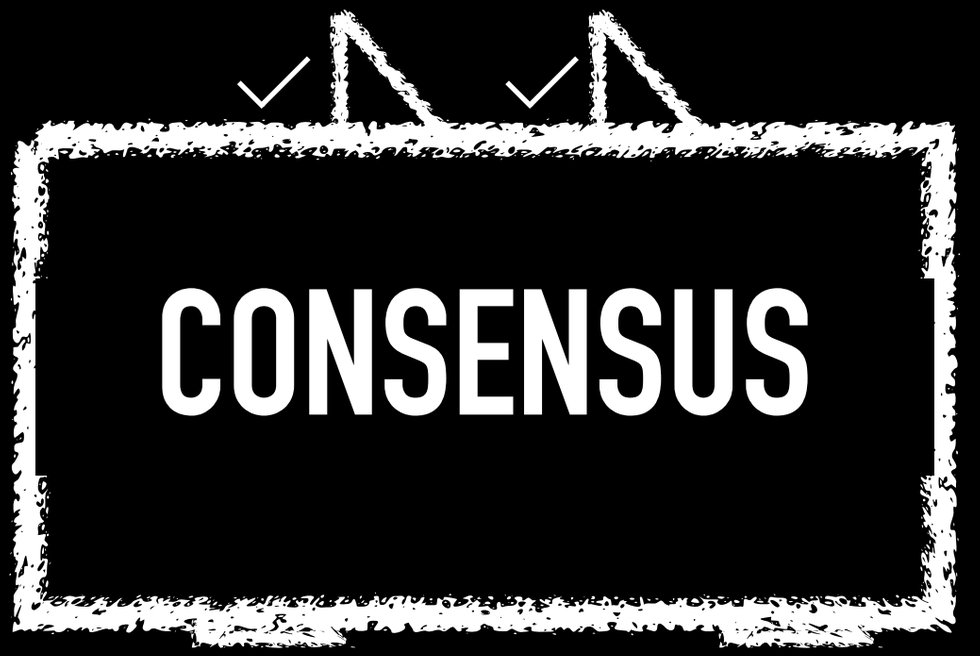






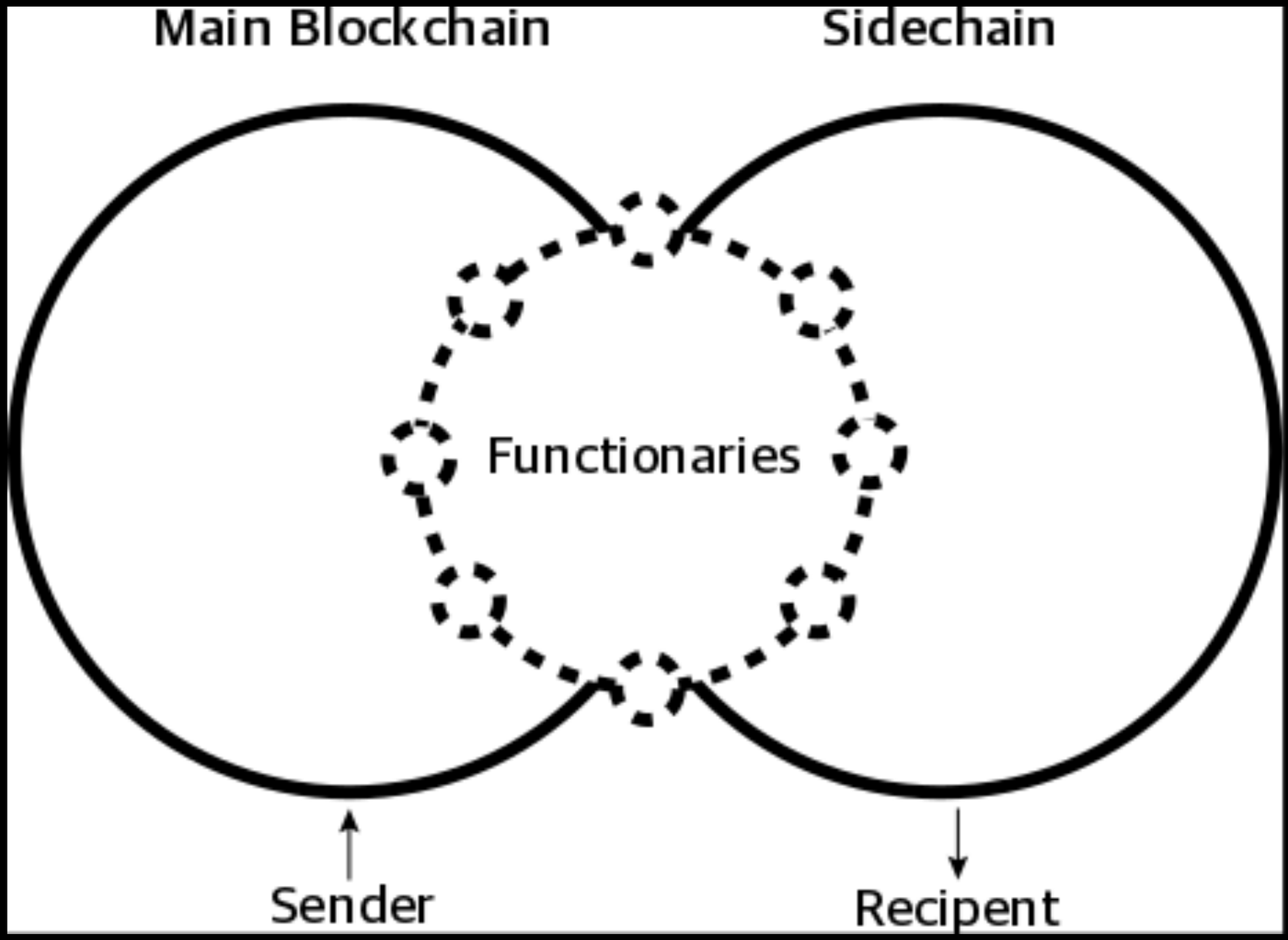


# IT IS SLOW.

# LACK OF LIQUIDITY.

# LACK OF PRIVACY.

# USING STRONG FEDERATIONS FOR FASTER BLOCKCHAIN TRANSACTIONS



# MARTA PIEKARSKA

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# Panel on ICSNC/INNOV
# Topic: Trusted and Scalable Systems and Services: Challenges

# Scalability problems in Software Defined Networking and Network Function Virtualization technologies

**Eugen Borcoci**
**University Politehnica Bucharest**
**Electronics, Telecommunications and Information Technology Faculty ( ETTI)**

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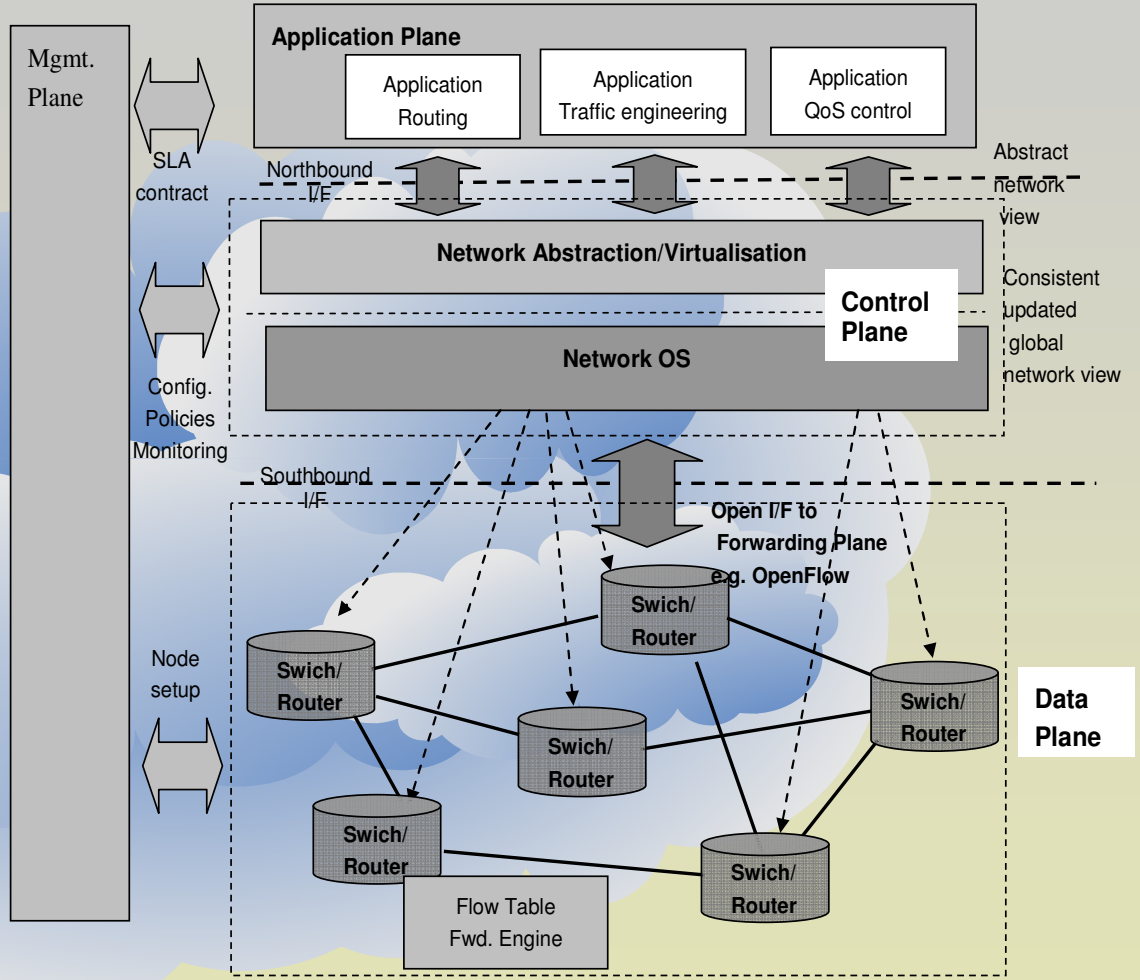
**Softnet 2016, Rome, August 21-25, 2016**

# SDN, NFV – scalability challenges

- **SDN – novel approach for networking control**
  - **strong support from industry**
  - **SDN – applicable in Clouds, WANs, IoT, vehicular, 5G**
- **SDN concepts and advantages:**
  - **Control Plane (CPI) and Data Plane (DPI) separation**
  - **centralized logical control and view** of the network
    - underlying network infrastructure is abstracted to applications
    - common APIs ( northbound I/F)
  - Open I/Fs  Southbound I/F CPI (controllers - DPI elements)
    - E.g. OpenFlow
  - **Network programmability**: by external applications including network management and control
  - **Independency of operators** w.r.t. network equipment vendors
  - Increased network reliability and security

# SDN, NFV scalability challenges

- **SDN Basic Architecture**
- **Network OS:**
  - Distributed system that creates a consistent, updated network view
  - Executed on servers (controllers) in the network
  - Eg.: NOX, PoX, ONIX, HyperFlow, Floodlight, Trema, Kandoo, Beacon, Maestro,..
- **SDN controller uses forwarding abstraction in order to:**
  - Collect state information from forwarding nodes
  - Generate commands to forwarding nodes

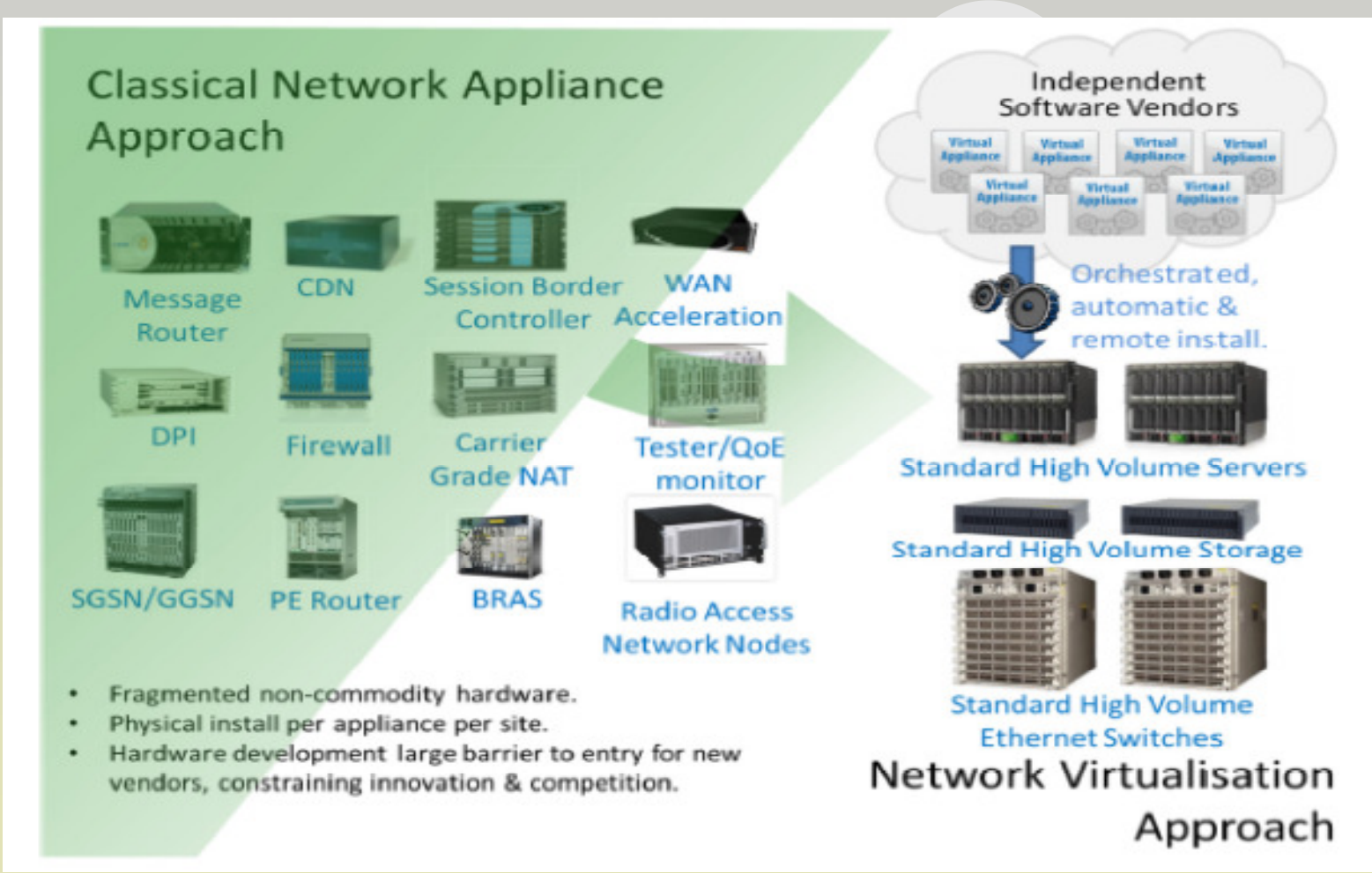


# SDN,NFV – scalability challenges

- **Network Function Virtualization : concepts and advantages**
  - **Main actor ETSI, ….**
  - Using COTS computing HW to provide **Virtualized Network Functions (VNFs)** through **SW virtualization**
    - Sharing of HW and reducing the number of different HW arch.
  - **High flexibility in assigning VNFs to HW**
    - better scalability (hope)
    - decouples functionality from location
    - enables time of day reuse
    - **Virtualization-** → flexibility and resource sharing
  - **Rapid service innovation** through SW -based service deployment
  - Common automation and operating procedures ⇒ higher **operational efficiencies**
  - **Reduced power consumption**
    - (migrating workloads and powering down unused HW)
  - **Standardized and open I/Fs**: between VNFs infrastructure and mgmt. entities

# SDN,NFV- scalability challenges

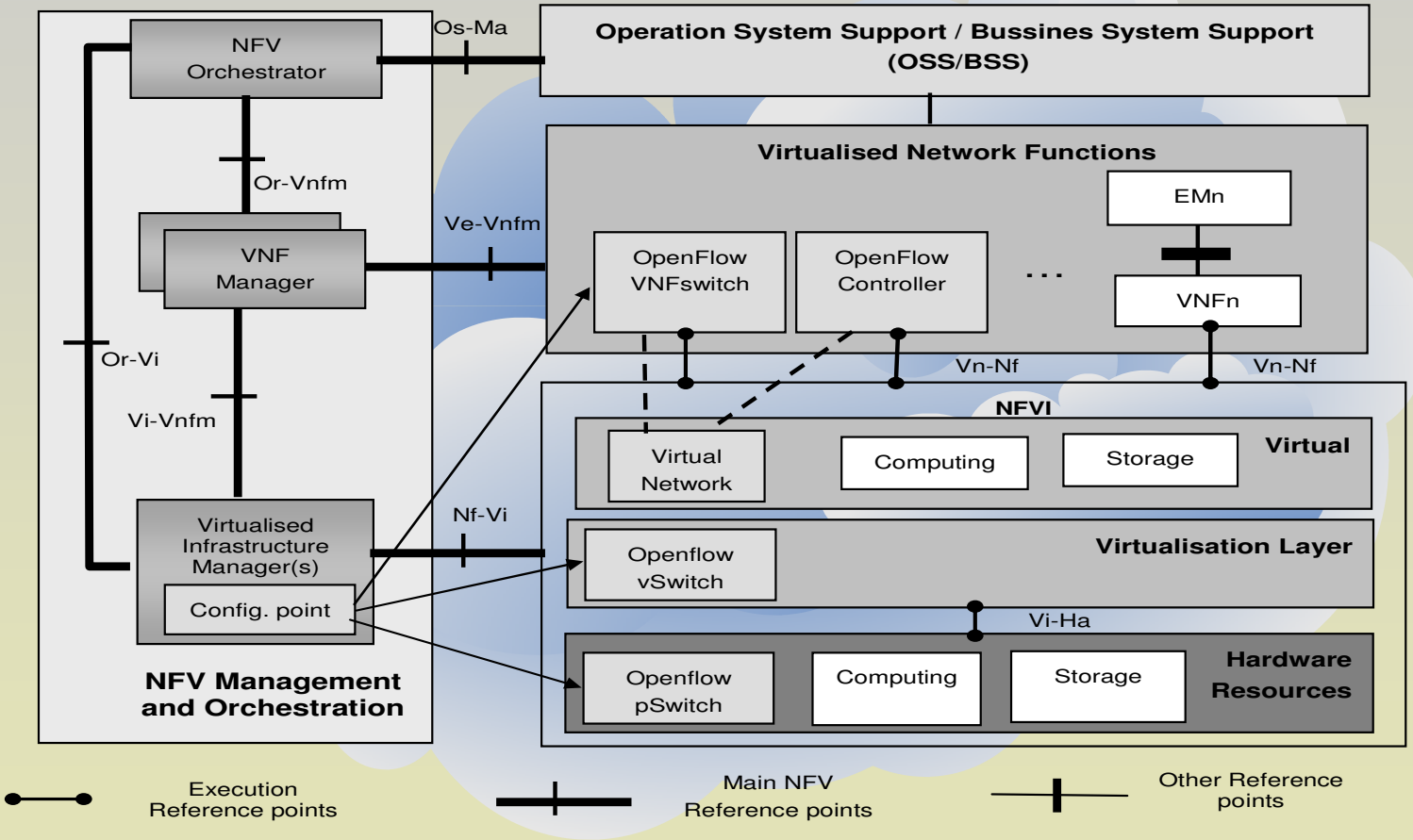
- **NFV vision (source : ETSI)**



# SDN,NFV- scalability challenges

- **NFV, SDN – are complementary**
  - **NFV + SDN- architectural example**

*Source: "SDN and OpenFlow World Congress", Frankfurt, October 15-17, 2013*



# SDN,NFV- scalability challenges

- **Why SDN scalability-related concerns "?**
  - Vertical scalability- apparently – no major issue
  - Horizontal scalability- it still a problem
  - **Centralized control plane** (at least logical)
    - signaling overhead ( forwarders <--> controllers)
    - central controller limitations: not scale for large networks (no. of switches, flows, bandwidth, etc.)
    - Initial SDN concepts : no control communication between forwarders → the power of a distributed system is partially lost
    - single controller- > single point of failure
  - **CPI/DpI decoupling issues**
    - need standard API between CpI/DPI - to allow their independent evolutions - not so simple
    - switch manufacturers should adopt the same APIs ( compatibility reasons)
  - **Current status? - no unanimous opinions w.r.t. SDN scalability solutions**
    - **Optimistic, Pessimistic, …**

# SDN,NFV- scalability challenges

- **Potential solutions proposed to solve the SDN scalability:**
  - (however, no unique solution can be unniversaly adopted)
  - **Direct solutions**
    - Increase controller processing power
    - Increase switch processing power
  - **Aggregation of rules**
  - **Proactive installation of rules**
    - Problems: no host mobility support, not enough memory in switches
  - Delegate (come back…) **more responsibilities to the data plane**
    - [e.g.Diffane, DevoFlow, …]
  - **Distributed controllers** ( need inter-controller communication)
    - Placement of controllers – open research issue
    - Flat structure - multiple controllers [e.g. ONIX, …]
    - Recursive controller design [e.g. Xbar, ..]
    - Hierarchical structure- multiple controllers [e.g.Kandoo, ..]

# SDN,NFV- scalability challenges

- **NFV scalability issues ( partial )**

- NFV needs to be acceptably scalable to high number (millions) of subscribers
  - Dynamic life-cycles of many NFV/VMs could be necessary

- NFV will only scale if all of the functions can be automated
  - -> automation of processes is important in NFV
  - dynamic environments requires that VNFs can be deployed and removed on demand and scaled to match changing traffic

- Open research issues
  - How to map VNFs onto VMs ?
    - Fixed/variable, 1 to 1, or ..
    - VNFs Migration policies ..
  - NFV need more study than just transferring carrier class NFs to the cloud
    - need to adapt cloud environments so as to obtain carrier-class behaviour

# SDN,NFV- scalability challenges

- **Conclusions**
  - Scalability solutions for SDN, NFV- still in research focus
  - Progress has been made in last years( both in concepts and also implementations)
  - Thank you !

# SDN,NFV- scalability challenges

## References


1. ETSI- Network Functions Virtualization – Introductory White Paper, https://portal.etsi.org/nfv/nfv_white_paper.pdf
2. ETSI GS NFV 002 v1.2.1 2014-12, NFV Architectural Framework
3. ONF, “OpenFlow-Enabled SDN and Network FunctionsVirtualization,” https://www.opennetworking.org/images/stories/downloads/sdn-resources/solutionbriefs/sb-sdn-nvf-solution.pdf;
4. https://www.sdxcentral.com/sdn-nfv-use-cases/
5. M.Mendonca, et. al., A Survey of Software-Defined Networking: Past, Present,and Future of Programmable Networks, 2014, http://hal.inria.fr/hal-00825087/
6. J.Matias, J.Garay, N.Toledo, J.Unzilla, and E.Jacob, “Toward an SDN-Enabled NFV Architecture”, IEEE Communications Magazine, April 2015