NEXT GENERATION INTERNET

NGI0: Come work for the internet

NGI Forum, Helsinki, September 2019 Michiel Leenaars

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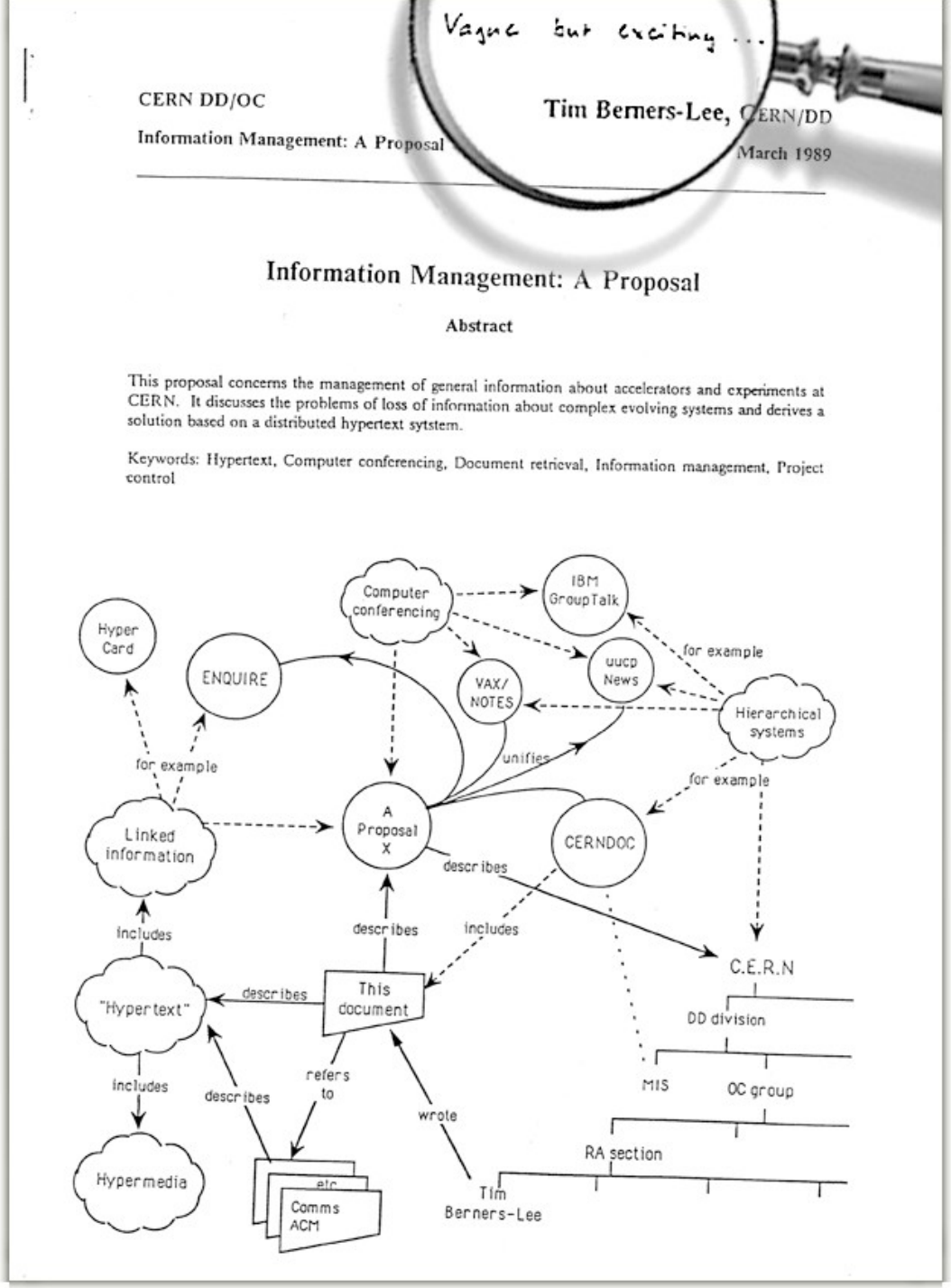

A mere thirty years ago..

... the world wide web was still a “vague but interesting” proposal inside CERN to manage information

... Stichting NLnet formally became a legal entity (a foundation), in an effort to scale up the adoption of the early internet in Europe (after 7 years of informal operations)

... and it caught on

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“From utopia to dystopia in just ~~29~~ [30] short years”

“We demonstrated that the Web had failed instead of served humanity, as it was supposed to have done, and failed in many places. The increasing centralization of the Web ended up producing—with no deliberate action of the people who designed the platform—a large-scale emergent phenomenon which is anti-human.”

Tim Berners-Lee

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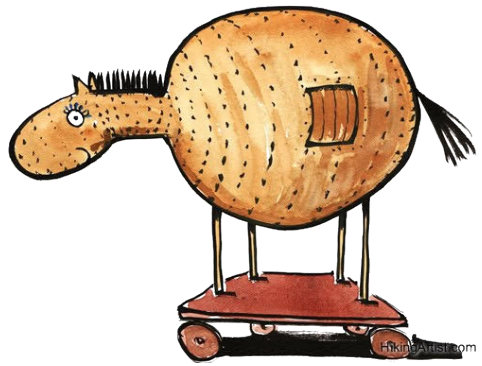
Problematic to the core

"The NSA has built an infrastructure that allows it to intercept almost everything. With this capability, the vast majority of human communications are automatically ingested without targeting."

Whistleblower Edward Snowden
Interview in The Guardian, 2013



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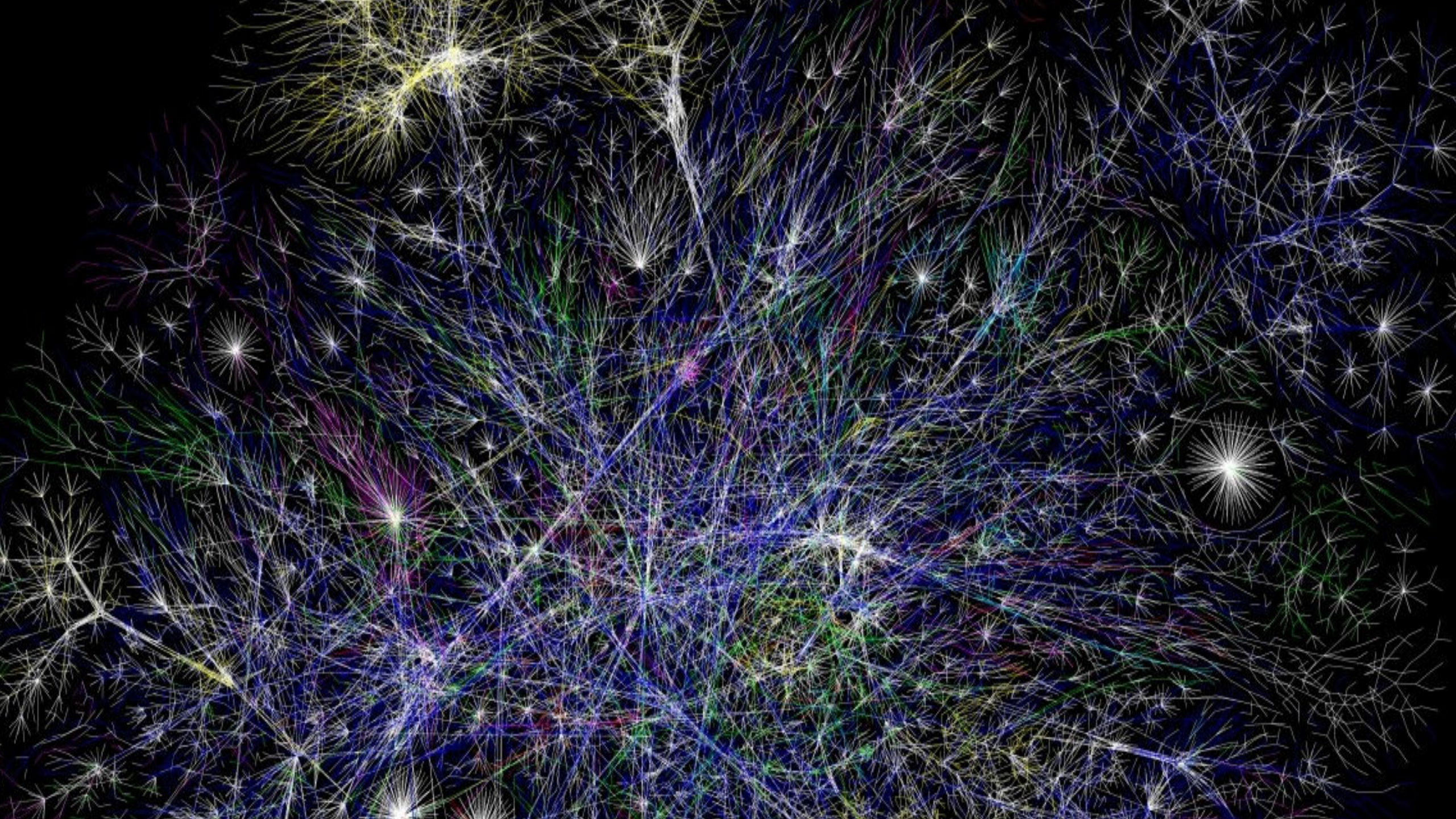

TODAY WE CREATE THE

INTERNET

OF TOMORROW

nlnet FOUNDATION

NGI Study
NGI Vision

"The overall mission of the Next Generation Internet initiative is to re-imagine and re-engineer the Internet for the third millennium and beyond. **We envision the information age will be an era that brings out the best in all of us.** We want to enable human potential and creativity at the largest possible scale. In order to preserve and expand the European way of life, we shape a value-centric, human and inclusive Internet for all."

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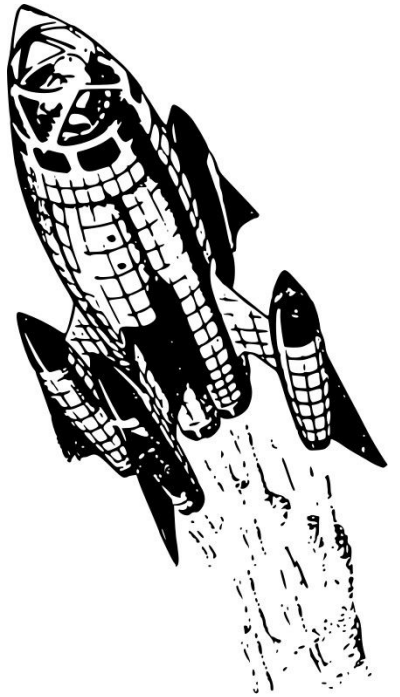
NGI is a moonshot ++ effort

- The internet is the **largest** and **most pervasive** technical construct ever made by humans
- And we need to change it with almost 4 billion people ‘on board’, on a shoe string budget
- High political stakes. High economic stakes. Highly critical users users. Overloaded with expectations. From everybody.
- Work consistent and forward-thinking. **No time to lose.**



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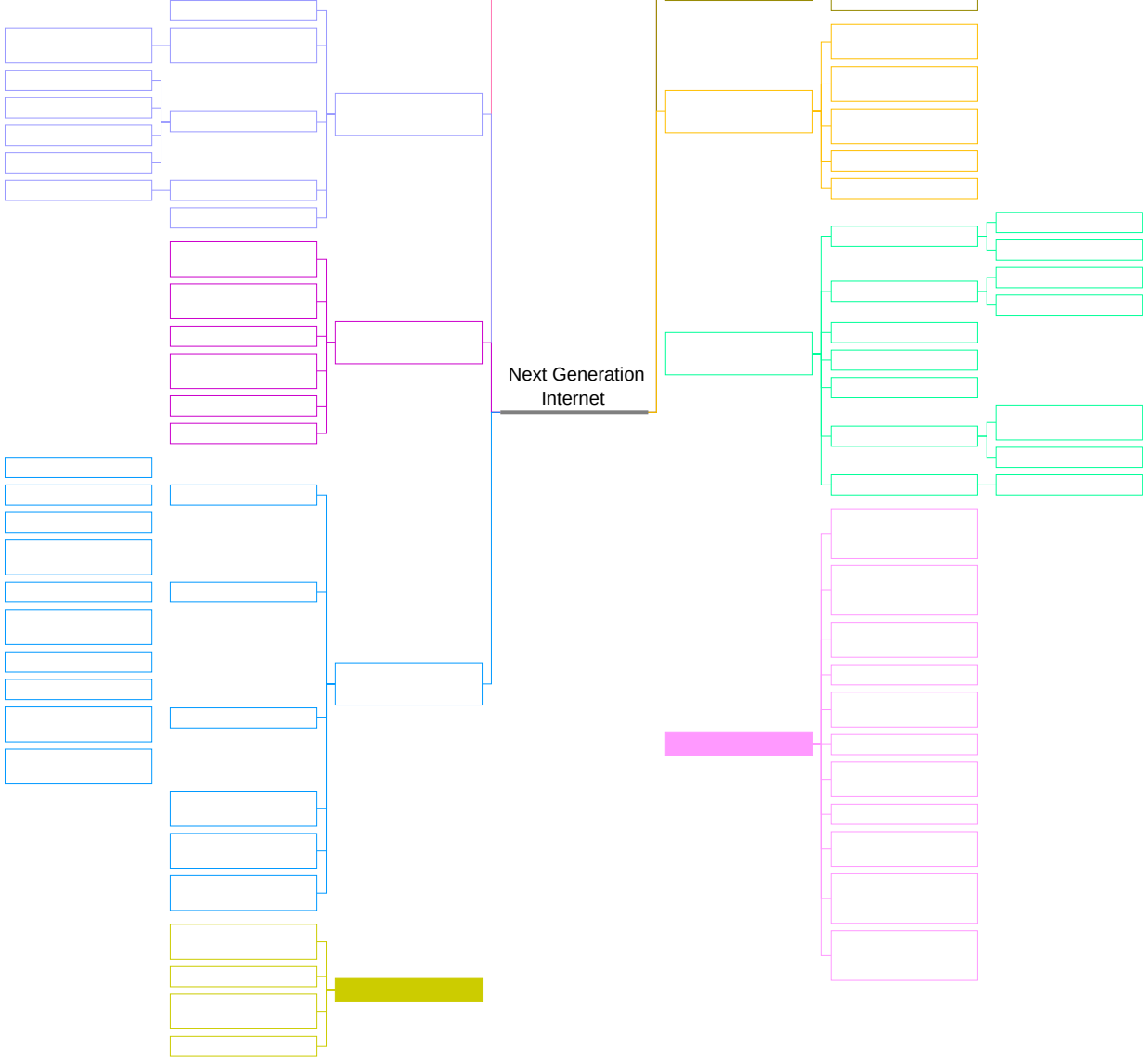

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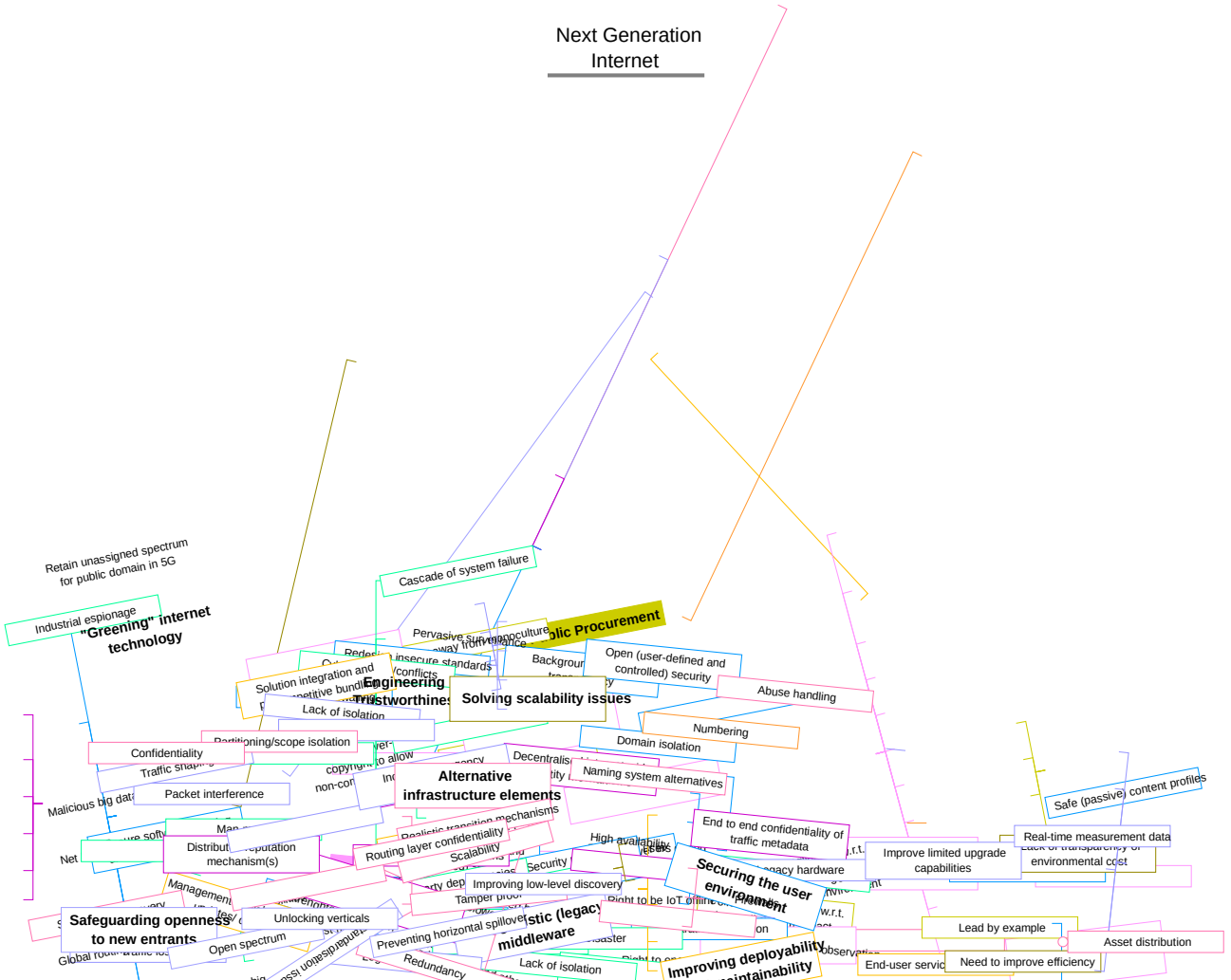
Next Generation Internet
Retain unassigned spectrum for public domain in 5G
Industrial espionage
"Greening" internet technology
Cascade of system failure
Pervasive Surveillance
Public Procurement
Solution integration and
Engineering trustworthiness
Solving scalability issues
Open (user-defined and controlled) security
Abuse handling
Lack of isolation
Numbering
Domain isolation
Partitioning/scope isolation
Confidentiality
Traffic shaping
Alternative infrastructure elements
Naming system alternatives
Packet interference
Malicious big data
Realistic transition mechanisms
Routing layer confidentiality
Scalability
Distribution mechanism(s)
End to end confidentiality of traffic metadata
Improve limited upgrade capabilities
Real-time measurement data
Safe (passive) content profiles
Improving low-level discovery
Securing the user environment
Tamper proof
Safeguarding openness to new entrants
Unlocking verticals
Open spectrum
Preventing horizontal spillover
middleware
Lead by example
Asset distribution
Need to improve efficiency
Improving deployability
Lack of isolation
Redundancy

NGI ZERO

RIPE NCC

RIPE NETWORK COORDINATION CENTRE

DIGITALEUROPE

GÉANT

Networks • Services • People

EDRi

euro-IX

Internet Society

EuroISPA

W3C®

fsfe

IETF®

eco

The larger ecosystem

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The overall mission of the Next Generation Internet initiative is to re-imagine and re-engineer the Internet for the next generations third millennium and beyond. We envision the information age will be an era that brings out the best in all of us. We want to enable human potential and creativity at the largest possible scale. In order to preserve and expand the European way of life, we shape a value-centric, human and inclusive Internet for all.

These ambitions need a solid foundation to build on. The legendary robustness of the Internet must become actual reality in the Next Generation Internet. A massive global fleet of connected devices is on its way to enhance and control our homes, factories, offices and vehicles. Technology is embedded in concrete, circling in space and is increasingly entering the intimacy of our human bodies. The Next Generation Internet has to be highly adaptive and **resilient**. Whatever parts of the network go down by some natural or other disaster, the effects on the

Each project has to be aligned with the key NGI pillars. These represent the European social and cultural values and long term economic interests:

- Resilience
- Transparent
Sustainably open

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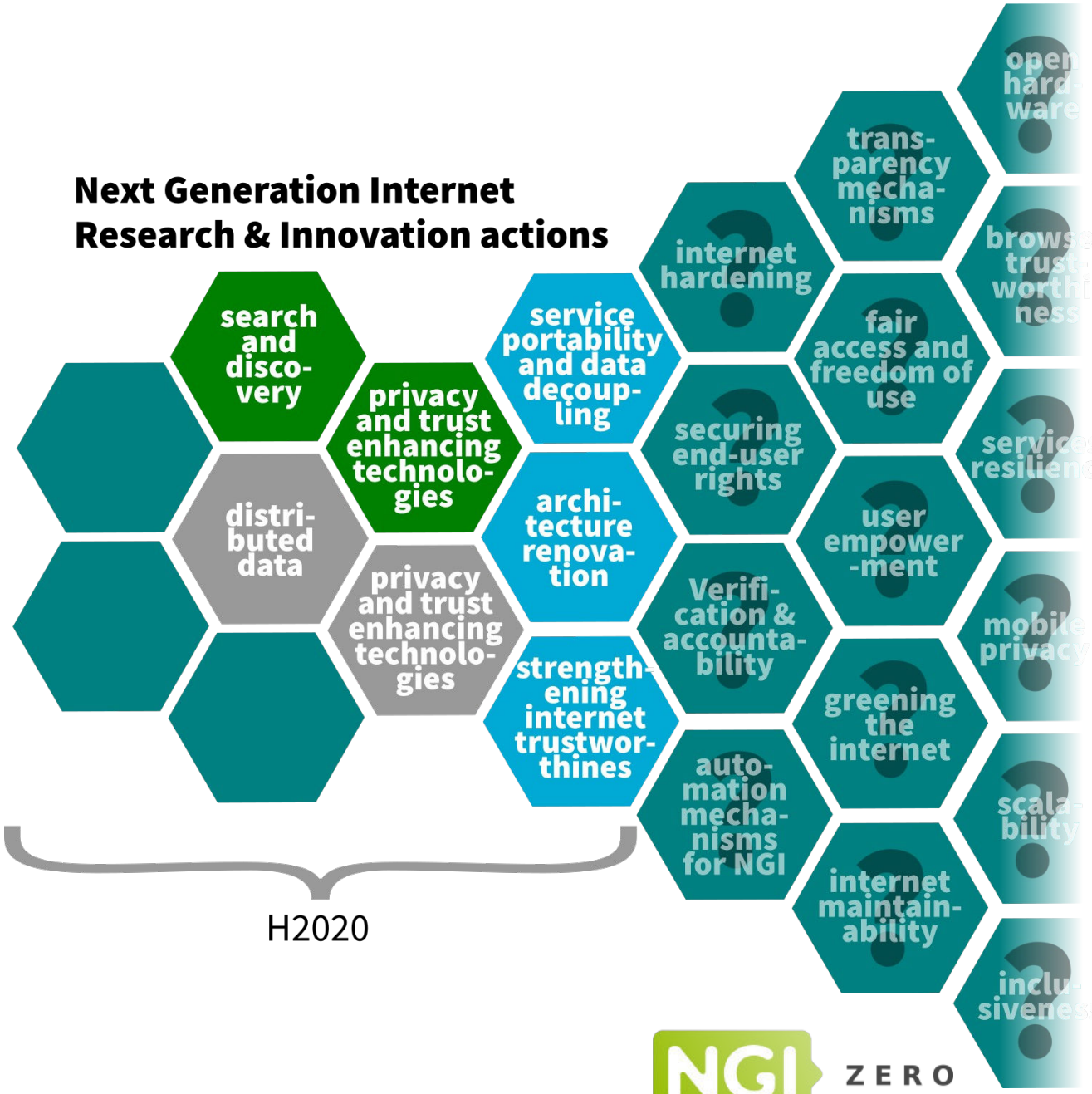
Next Generation Internet
Research & Innovation actions
search and discovery
distributed data
privacy and trust enhancing technologies
privacy and trust enhancing technologies
service portability and data decoupling
architecture renovation
strengthening internet trustworthines
internet hardening
transparency mechanisms
fair access and freedom of use
securing end-user rights
user empowerment
Verification & accountability
greening the internet
automation mechanisms for NGI
internet maintainability
H2020
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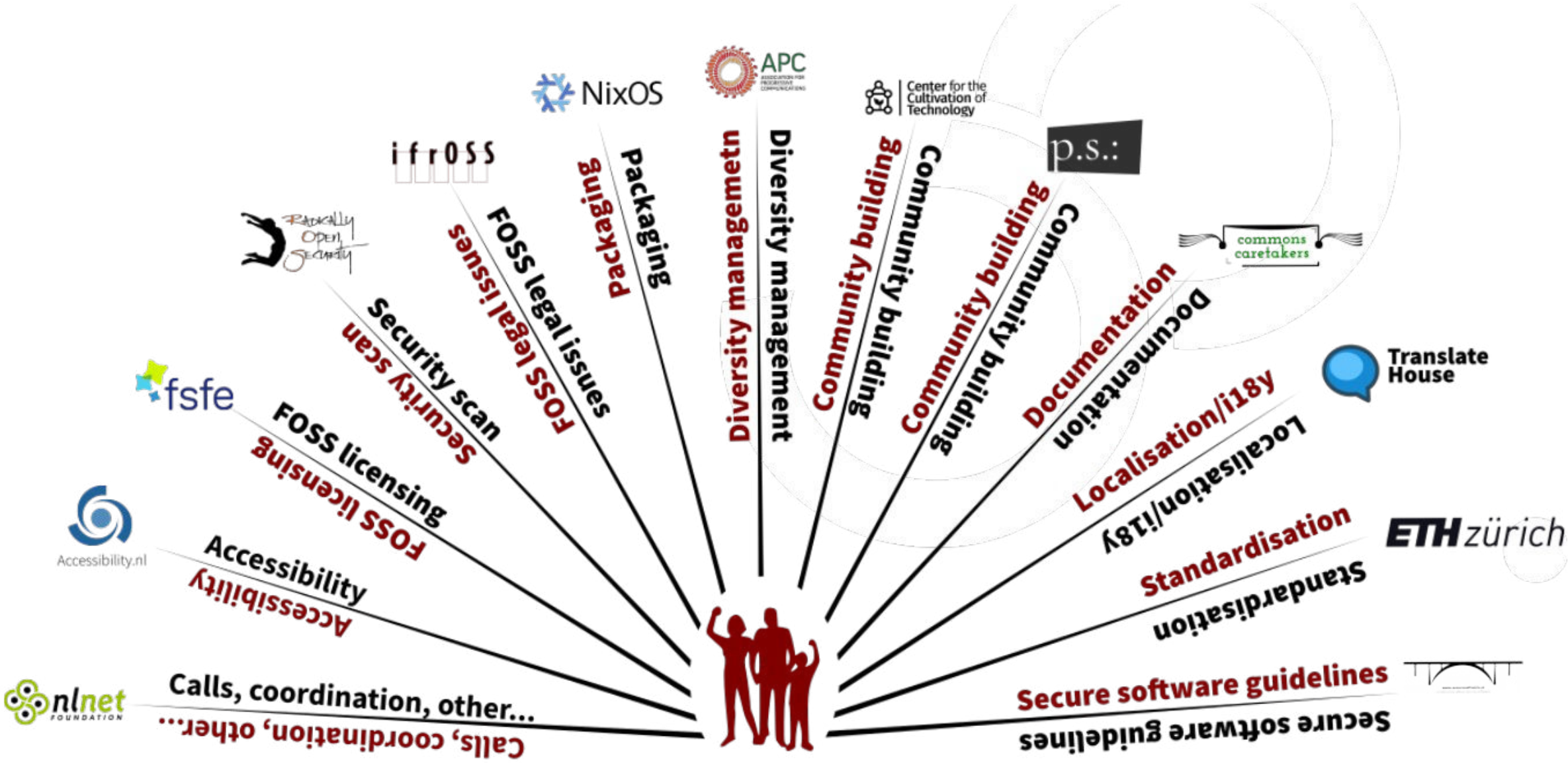

NixOS
APC
Center for the Cultivation of Technology
ifrOSS
p.s.:
Radically Open Security
commons caretakers
fsfe
Translate House
Accessibility.nl
ETH zürich
nlnet FOUNDATION
Packaging
Diversity management
Community building
Documentation
Localisation/i18y
Standardisation
Secure software guidelines
FOSS legal issues
Security scan
FOSS licensing
Accessibility
Calls, coordination, other...

NGI ZERO

5.6 million euro
in small grants
until 2021

43 active projects already running

> 90% new to H2020

Competitive calls every **two months** until the budget is allocated.

Projects between 5k-50k
Follow-up possible

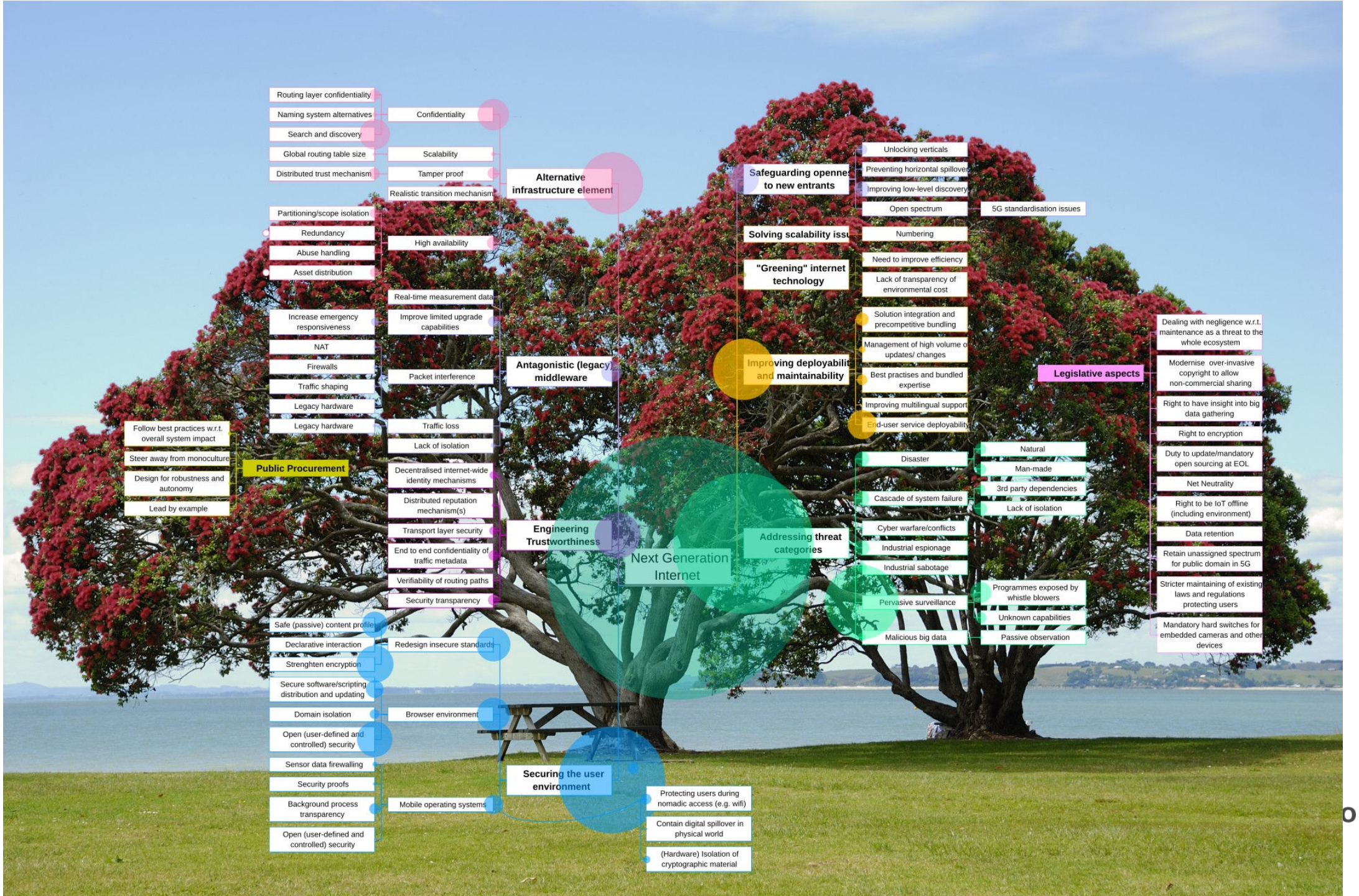
Walk the talk:
Inclusion
Security
Localisation
Open Standards
Free & Open Source
Deliver to deploy

Key characteristics

5.6 million euro
in small grants
until 2021

69 active projects already running

> 90% new to H2020


Next Generation Internet
Alternative infrastructure element
Routing layer confidentiality
Naming system alternatives
Search and discovery
Confidentiality
Global routing table size
Scalability
Distributed trust mechanism
Tamper proof
Realistic transition mechanism
Partitioning/scope isolation
Redundancy
Abuse handling
Asset distribution
High availability
Antagonistic (legacy) middleware
Real-time measurement data
Increase emergency responsiveness
Improve limited upgrade capabilities
NAT
Firewalls
Traffic shaping
Packet interference
Legacy hardware
Legacy hardware
Traffic loss
Lack of isolation
Public Procurement
Follow best practices w.r.t. overall system impact
Steer away from monoculture
Design for robustness and autonomy
Lead by example
Engineering Trustworthiness
Decentralised internet-wide identity mechanisms
Distributed reputation mechanism(s)
Transport layer security
End to end confidentiality of traffic metadata
Verifiability of routing paths
Security transparency
Safeguarding openness to new entrants
Unlocking verticals
Preventing horizontal spillover
Improving low-level discovery
Open spectrum
5G standardisation issues
Solving scalability issu
Numbering
"Greening" internet technology
Need to improve efficiency
Lack of transparency of environmental cost
Improving deployability and maintainability
Solution integration and precompetitive bundling
Management of high volume o updates/ changes
Best practises and bundled expertise
Improving multilingual support
End-user service deployabilit
Legislative aspects
Dealing with negligence w.r.t. maintenance as a threat to the whole ecosystem
Modernise over-invasive copyright to allow non-commercial sharing
Right to have insight into big data gathering
Right to encryption
Duty to update/mandatory open sourcing at EOL
Net Neutrality
Right to be IoT offline (including environment)
Data retention
Retain unassigned spectrum for public domain in 5G
Stricter maintaining of existing laws and regulations protecting users
Mandatory hard switches for embedded cameras and other devices
Addressing threat categories
Disaster
Natural
Man-made
3rd party dependencies
Lack of isolation
Cascade of system failure
Cyber warfare/conflicts
Industrial espionage
Industrial sabotage
Pervasive surveillance
Malicious big data
Programmes exposed by whistle blowers
Unknown capabilities
Passive observation
Safe (passive) content profiles
Declarative interaction
Redesign insecure standards
Strenghten encryption
Secure software/scripting distribution and updating
Domain isolation
Browser environment
Open (user-defined and controlled) security
Sensor data firewalling
Security proofs
Background process transparency
Mobile operating systems
Open (user-defined and controlled) security
Securing the user environment
Protecting users during nomadic access (e.g. wifi)
Contain digital spillover in physical world
(Hardware) Isolation of cryptographic material

Privacy and Trust Enhancing Technologies

Increasing the trustworthiness and privacy of the technology we depend on

69 projects ongoing in 22 countries

[5G] [AccessControl] [Accountability] [ActivityPub] [Android] [Anonymity]
[AttributeBasedAuthentication] [Attributes] [AuditTrail] [Auditability] [Backup] [BinarySeed]
[Biometric] [Blockchain] [Bootstrap] [Browser] [CMS] [Classification] [Client-side]
[ClientSideEncryption] [Clientside] [CodeGeneration] [Collaboration] [CommunitySetup]
[Configuration] [Cross-Device] [Cross-Implementation] [Cryptography] [DAT] [DCnet]
[DNS-over-TLS] [DNSSEC] [Data] [Datastore] [Deanonymisation] [Decentralised]
[Deepfake] [Desktop] [DesktopOS] [Device] [E-mail] [E2E] [ENUM] [EdgeComputing]
[Education] [EmbeddedSystems] [Encryption] [Federation] [FiatCurrencies]
[Fingerprinting] [Firmware] [FormalProofs] [FormalVerification] [Framework]
[Fundamental] [GDPR] [Geo-localisation] [HSM] [Hardware] [IETF] [IRTF]
[IdentityBasedEncryption] [IdentityManagement] [ImageProcessing] [InclusiveDesign]
[InformationQuality] [InstantMessaging] [Interoperability] [KSK] [Kernel] [Key-Recovery]
[KeyManagement] [Live-Distro] [ML] [MachineReadability] [MalwareAnalysis] [Messaging]
[Metadata] [Middleware] [Minimisation] [Misinformation] [Mixnet] [Mobile] [MobileApp]
[MobileInfrastructure] [MobileOS] [Modularity] [Monitoring] [MultiPartyComputation]
[Notary] [OSM] [Observability] [Offgrid] [OnionRouting] [Online] [Ontology] [OpenData]
[OpenHardware] [OpenSource] [OperatingSystem] [P2P] [PGP] [PKI] [POSIX]
[PasswordStore] [Payment] [PersonalServer] [Policy] [Portal] [Post-Quantum] [Privacy]
[PrivacyScore] [PrivacySettings] [ProfileManagement] [Profiling] [Protocol]
[QuantumNetworking] [Real-time] [Recovery] [Refactoring] [Reproducibility] [Reputation]
[Resume] [Revocation] [Risk-V] [SASL] [SaaS] [Scanning] [Security] [Self-SovereignIdentity]
[SelfSovereignIdentity] [Selfhosted] [Selfhosting] [Sensors] [SocialNetworking]
[SocialProtest] [Solid] [StandardSetting] [SystemsProgramming] [TLD] [TLS] [Tamper-proof] [TextEditor] [Transparency] [Trust] [TrustDelegation] [Trustmark] [UI] [UX] [Usability]
[VPN] [Videocalling] [VisualPrivacy] [Visualisation] [Voicecalling] [Voting] [W3C] [WebRTC]
[Webserver] [XMPP] [ZeroKnowledgeProof] [e-healthcare] [iOS]

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Different layers of trust

- New **end user applications** bringing Privacy and Trust to users
  - Conversations, Sylk, Briar, Autocrypt, Cryptpad, Manyverse, Wireguard client, Katzenpost, Ricochet Refreshed
- Human-centric middleware/**Enablers**:
  - IRMA, node-TOR, ValOS, Rocket CWMP, SCIM, ARPA2 ACL/SASL, dhcpanon, Solid Data workers, Offen, PowerDNS/DNSdist, Robur DNS, Web Shell
- OS level improvements, **alternative** OS-es and integration
  - Replicant OS, Mobile Nixos, Qubes, Spectrum, Wireguard, Reproducible Builds
- New **standards** and **protocols** to solve critical issues under the hood
  - DID*, GNU Name System*, IMSI Pseudonymisation, TLS-KDH, SASL XMSS, Reowolf
-

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Different layers of trust

- Technical and fundamental **building blocks** for trustworthiness and security assessment
  - e.g. Verifpal, Libre-RISCV SoC, IMSI pseudonymisation, Identity Based Encryption, Tor Padding, GNU Mes, Etesync, Vita, Opaque Sphinx, OpenPGP CA, F-Droid tracking the trackers, GNU Taler, Virtualising device firmware
- Open **Hardware** and physical isolation
  - Nitrokey, Betrusted, ZsipOS, Zerocat Chipflasher, Mega65 Phone
- **Explorative**
  - Distributed private trust, ValOS, Vframe

Search and Discovery

The very fabric of sharing

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43 projects ongoing in 17 countries

[AI] [AR] [ActivityPub] [Agents] [Annotation] [Archiving] [Art] [Attribution] [AugmentedReality] [Automation] [Blockchain] [BrowserPlugin] [CMS] [CPU] [CVE] [Citations] [Collaboration] [Contacts] [Crawling] [CreativeCommons] [Crowdfunding] [Cryptocurrency] [Cryptowallet] [DANE] [DAT] [DHT] [DNS] [DataPlacement] [Dataset] [Decentralised] [Discoverability] [Discovery] [Education] [Environment] [EventTickets] [Federation] [FraudPrevention] [GDPR] [Geo-localisation] [Graph] [Hardware] [IETF] [IPFS] [Indexing] [InformationQuality] [KeyExchange] [LocalContent] [LocalSearch] [MachineLearning] [Malware] [Measurement] [MetaSearch] [Metadata] [Metasearch] [Middleware] [Misinformation] [Mobile] [Monitoring] [Multimedia] [NamingSystem] [OSM] [Obfuscation] [Offchain] [OpenAccess] [OpenData] [OpenHardware] [OrganisationID] [Overlay] [P2P] [PKI] [PeerEndorsement] [PersonalArchive] [PersonalSearch] [Policy] [Provenance] [Proxy] [QuantifiedSelf] [Recycling] [Routing] [Scraping] [SearchData] [SecurityUpdates] [Self-hosted] [SemanticWeb] [Services] [SocialNetworking] [Software] [Spyware] [Study] [TextEditor] [TextMining] [Traffic] [UI] [UX] [Video] [Visualisation] [VoiceAssistants] [Webmention] [Workflow] [e-Payments] [education]

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Discovery is everywhere...

- End user applications
  - Searx, Plaudit, Blink RELOAD, Sonar, El Repo, Transparency Toolkit, CoinDiscovery, Peertube, Explain, Search and Displace, Discourse, Mailpile, Lizard, Mynij
- Technical building blocks
  - GNU Name System, Software Vulnerability Discovery, IPFS Search, DID Resolver/Registrar, Variation Graph, Neuropil, P2PCollab
- Community infrastructure
  - StreetComplete, Fediverse.Space, SCION Geotagging, DeltaBot, In Common, SCION-SWARM, Fediverse Space, PoliFLW, WebXRay, OpenKI, Perspectives
- Explorative search and discovery
  - Decentralized privacy preserving search

- What if we can empower users to apply their ethical preferences to search results?
  - For instance Open green web
- What if we can let users know which site abuse their privacy before they visit the that site?
  - For instance WebXRay

Example:
Ethical search

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What if we can give a unified search interface without having to share data with anyone

- For instance **private Searx**

Including their own email and the devices in their own house...

- For instance **Mailpile** and **neuropil**

Example:
Private search

the next generation internet initiative cordially invites you to

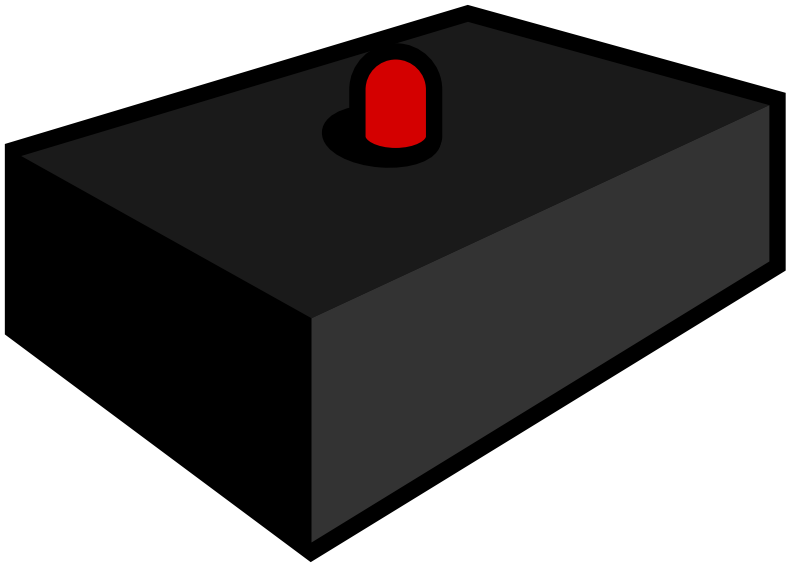
work for the internet

Full time and part-time paid and unpaid positions available.

- ☛ Work from home (or anywhere you like)
- ☛ Collaborate with people from all over the world
- ☛ Challenge your talents to the extreme
- ☛ Help save future generations

European Commission

Where does **your** idea fit?



We are searching for awesome projects to fund.

The next deadline is October 1st.

What can **you** do for the open internet, for the privacy and security of users?

What better alternative can **you** create, or add to?

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Image courtesy of VerifPal

join us and help discover and shape the next generation internet

and claim your spot in human history

Full time and part-time paid and unpaid positions available.

Read all about it on
- https://nlnet.nl/discovery
- https://nlnet.nl/PET
- https://ngi.eu

NGI ZERO

European Commission

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Questions? Enjoy Helsinki!

NGI Zero project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 825322 and 825310. Visit: https://NLnet.nl for more information.