

FUTURE INTERNET INITIATIVE IN FINLAND

Future Internet Assembly Madrid 2008

TIVIT

The logo consists of the word 'TIVIT' in a bold, black, sans-serif font. The letters 'I' and 'I' have small white circles above them. Below the letters, a network of white lines connects them to a horizontal line that spans the width of the page. From this horizontal line, a vertical line descends from the center, and two other vertical lines descend from the left and right sides of the 'I' and 'I' characters respectively.

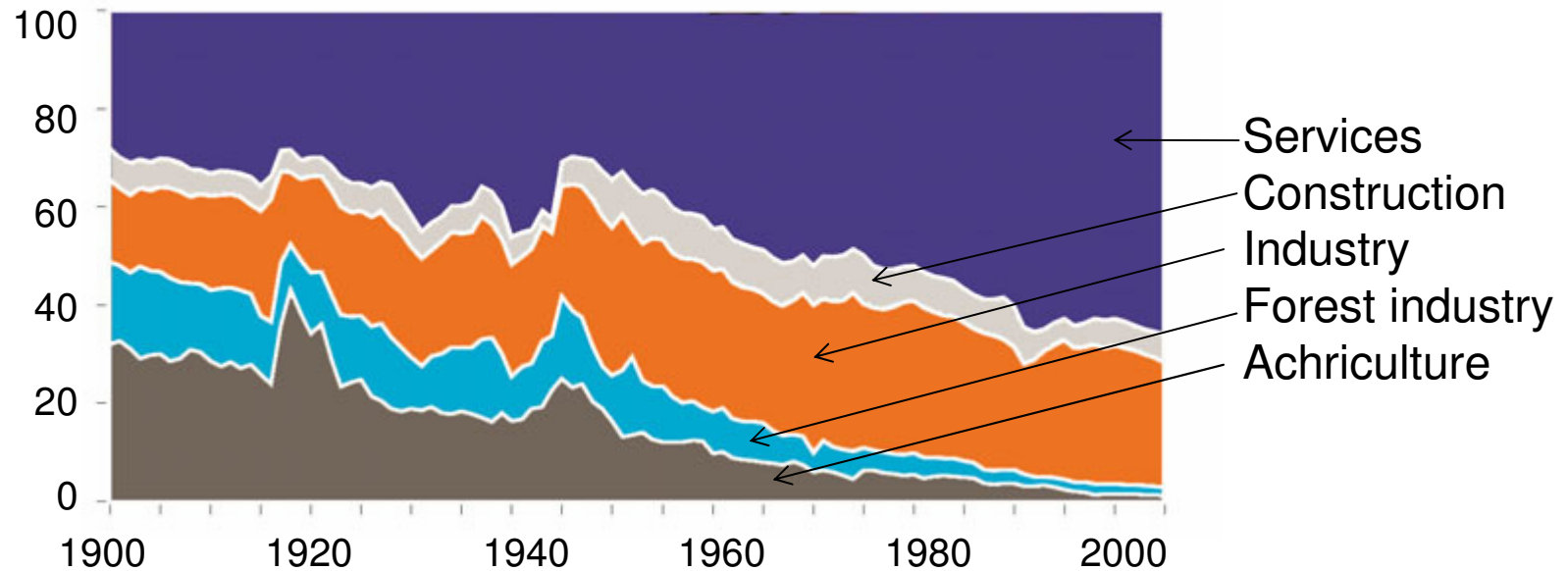
Reijo Paajanen
CEO

Tieto- ja viestintäteollisuuden tutkimus
TIVIT Oy

FUTURE INTERNET PROGRAMME ENVIRONMENT IN FINLAND

T i V i T

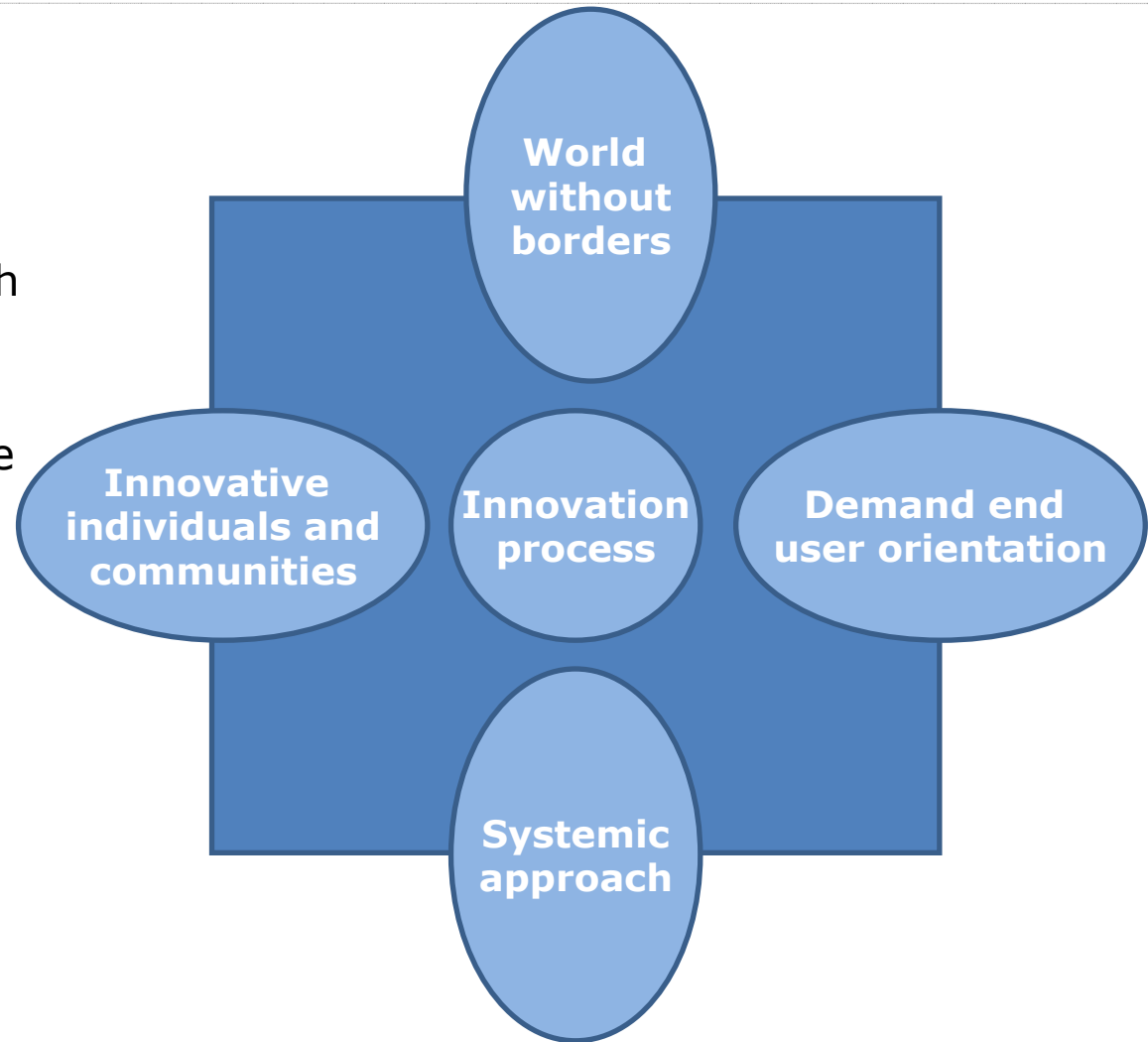
The logo consists of the letters T, i, V, i, T in a stylized font. Below the letters, there is a white line that starts from the bottom of the first 'T', goes right, then down, then right again, connecting to the bottom of the first 'i'. A similar path connects the bottom of the second 'i' to the bottom of the 'V'. Another path connects the bottom of the 'V' to the bottom of the second 'i'. Finally, a path connects the bottom of the second 'i' to the bottom of the last 'T'. This creates a series of connected horizontal and vertical lines that resemble a circuit board or a network diagram.

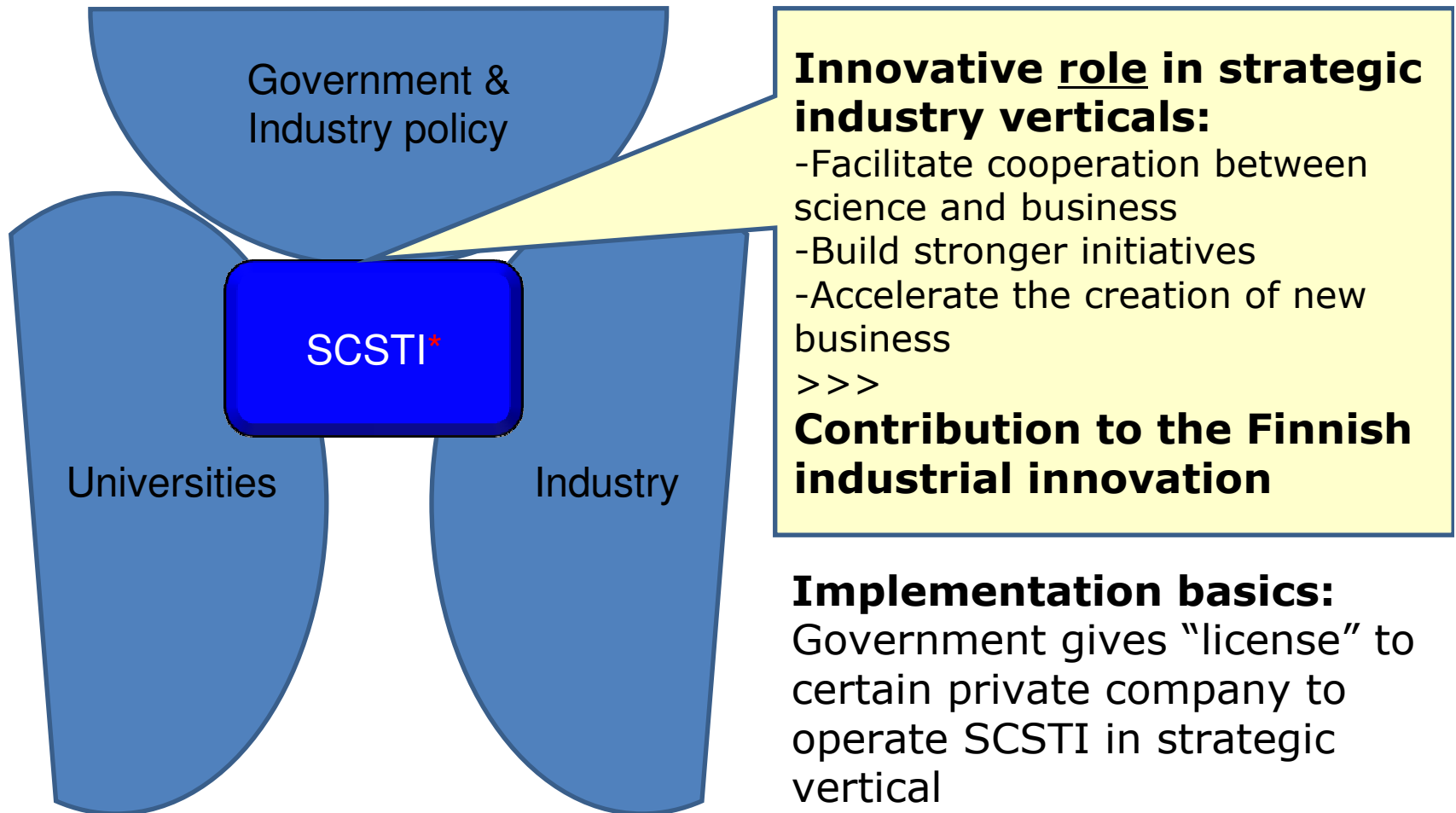


Relative (%) GDP development in Finland in main industry verticals between 1900-2005

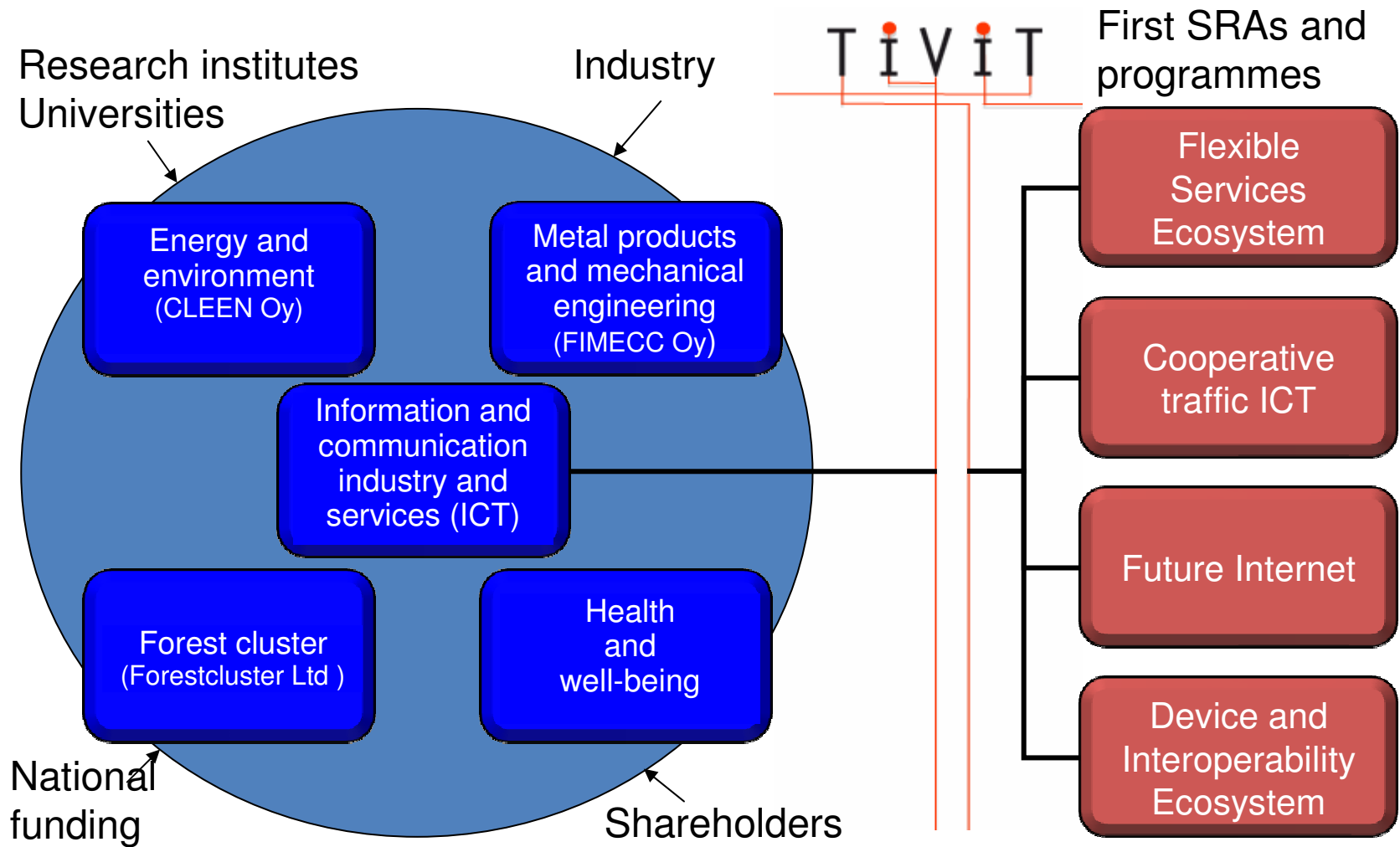
Source: Statistics Finland (http://www.stat.fi/index_en.html)

- Knowledge, strong competence base and high education do create the basement for Finnish competitiveness
- Innovation has more and more important role behind the new growth and productivity development





TIVIT IN FINNISH SCSTI* (SHOK) - NETWORK



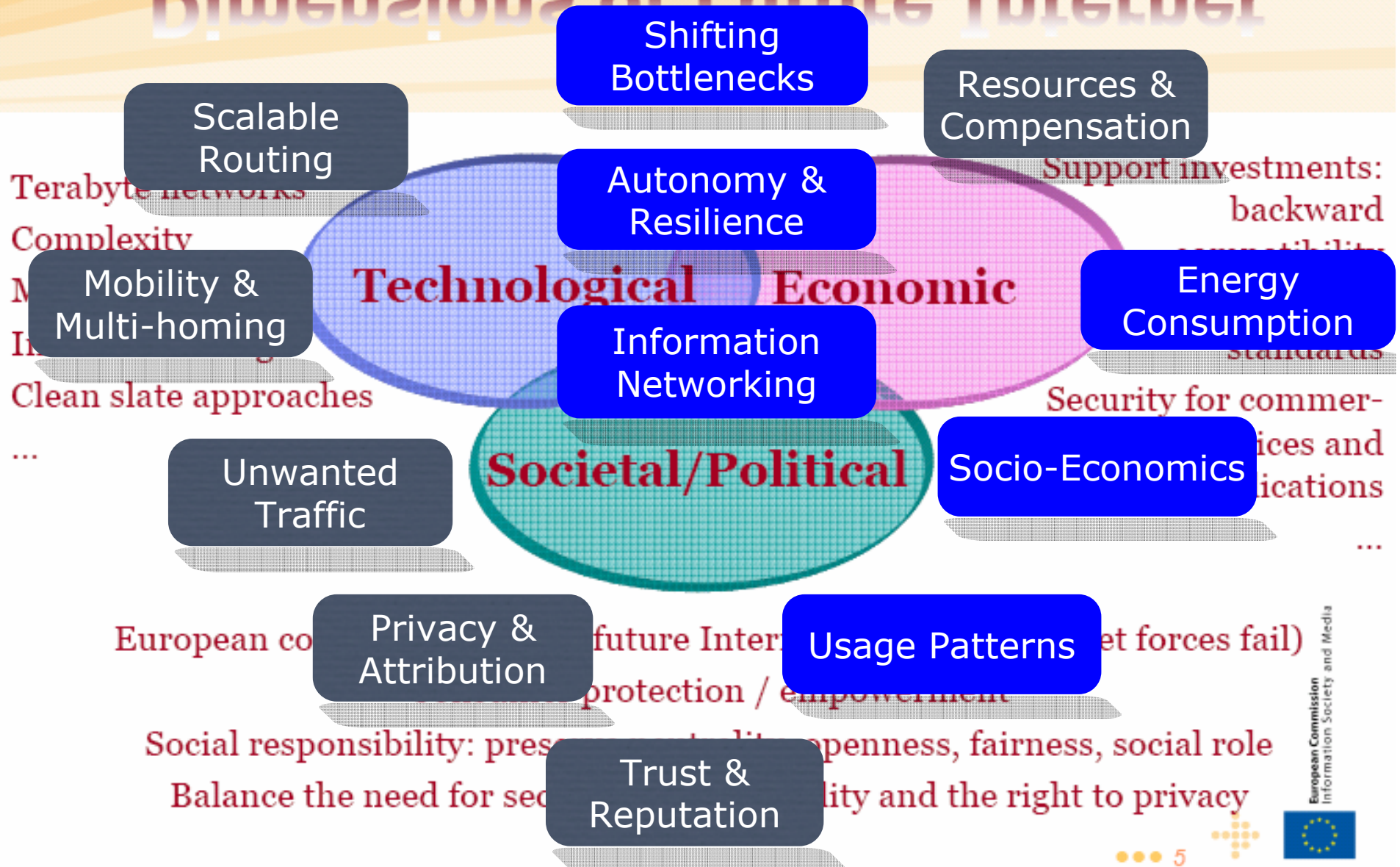
TIVIT – FUTURE INTERNET PROGRAMME

TIVIT

The word "TIVIT" is rendered in a black, monospaced, all-caps font. The two 'i's have white circular dots above them. Below the text, a white line graphic starts from the base of each letter, extends horizontally, and then turns vertically downwards, creating a central vertical line and two side lines that resemble a circuit board or a stylized 'T' shape.



Dimensions of Future Internet



UNWANTED TRAFFIC

- Fight spam, DDoS, and phishing by making bad traffic uneconomical
- *near term: protocols stopping unwanted traffic in various layers*
- *medium term: end-hosts control traffic with upstream protocols*
- *long term: economic solutions; completely new architectures*

SCALABLE ROUTING

- Fight the exponential growth and complexity of routing system
- *near term: IPv6 migration; Renews role of NATs; BGP housekeeping*
- *medium term: cross-layer interactions, mobility, multi-homing*
- *long term: compact/hierarchical routing; long tail topologies*

MOBILITY AND MULTI-HOMING

- Support mobility and multi-homing support at different levels
- *near term: mobility and multi-homing performance studies, etc.*
- *medium term: context awareness, new forms of connectivity*
- *long term: infrastructureless networks, compensation*

RESOURCES AND COMPENSATION

- Study compensation methods for resource and congestion control
- *near term: external triggers, reactive control, new algorithms*
- *medium term: incentives for correct behaviour and flexibility*
- *long term: new compensation methods, market structures*

PRIVACY AND ATTRIBUTION

- Balancing of privacy and accountability, mechanisms for trade-off
- *near term: empirical research to expose issues in different domains*
- *medium term: identities with balanced privacy and attribution*
- *long term: economics of identity, privacy, and attribution*

TRUST AND REPUTATION

- Study trust mechanisms including human factors, legal issues
- *near term: experiments with various approaches, social networks*
- *medium term: new concepts and technologies for expressing trust*
- *long term: trust-related cognitive informational processes*

T i V i T CHALLENGES

INFORMATION NETWORKING

- Internet is no longer a network connecting nodes, but more often connecting information. The consequences of this are likely to require re-scrutinizing the concepts of naming, addressing, and routing, and will also be reflected to the problems of privacy, accountability, trust and reputation.

USAGE PATTERNS

- How do users create, search and share information in the future Internet? How do they maintain social networks and communicate with others? How do they plan and carry out their daily activities in work and leisure? These and other similar questions define the thrust of this line of work.

NETWORK SOCIO-ECONOMICS

- Future Internet needs technical solutions, embedded into
- architecture, that enable it to enforce rules of appropriate
- behaviour in an accountable way. This covers, e.g., policydriven service and network configuration and deployment, Lessigian code and so-called soft law.

AUTONOMY AND RESILIENCE

- The scale and complexity of future Internet requires radical advances in configuration agility, covering themes such as zero configuration and autonomous resilience. This requires understanding of the underlying socio-economics, and possibly application of complex adaptive systems.

ENERGY CONSUMPTION

- Energy conservation is a critical societal issue that also ICT must consider. For Future Internet, the whole stack must be scrutinised from this angle, all the way from energy constrained network discovery and routing to high-level adaptation.

SHIFTING BOTTLENECKS

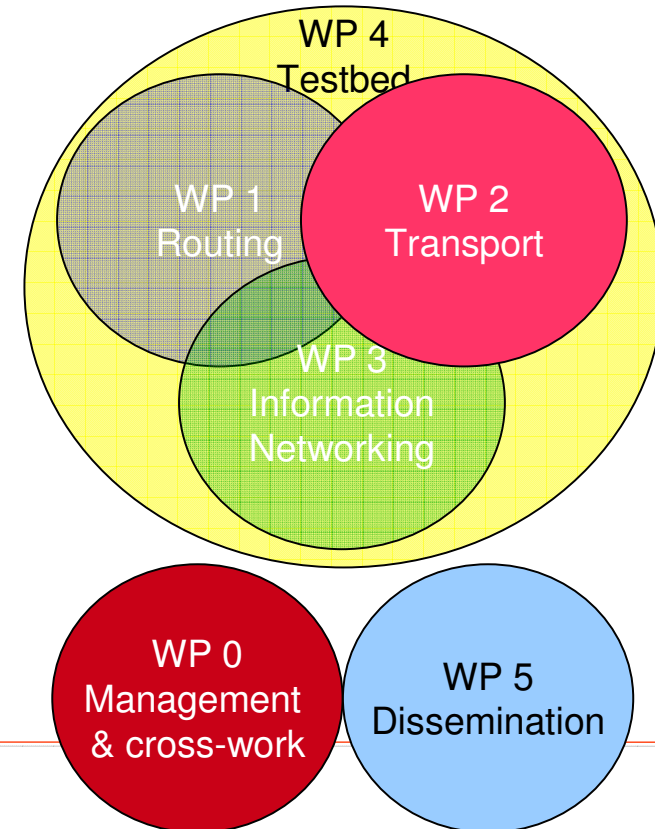
- Internet traffic demand has historically doubled every year, and the trend is likely to continue. Moore's law no longer holds for processors, while storage capacities will continue their increase. All this may change the optimal allocation of work between processing, storage, and communication.

Vision: Future Internet = a mission critical backbone of global information society

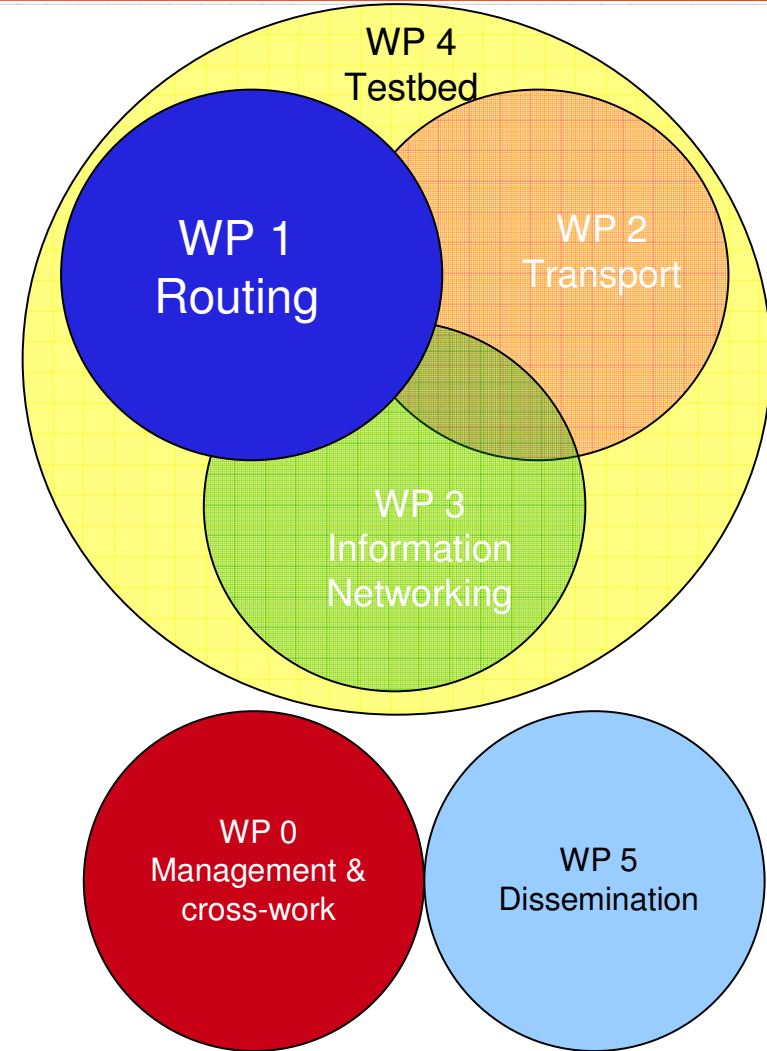
Mission: Enhance the Internet technology and ecology as a *platform for innovation* while providing strong governance over the use of the network resources and information



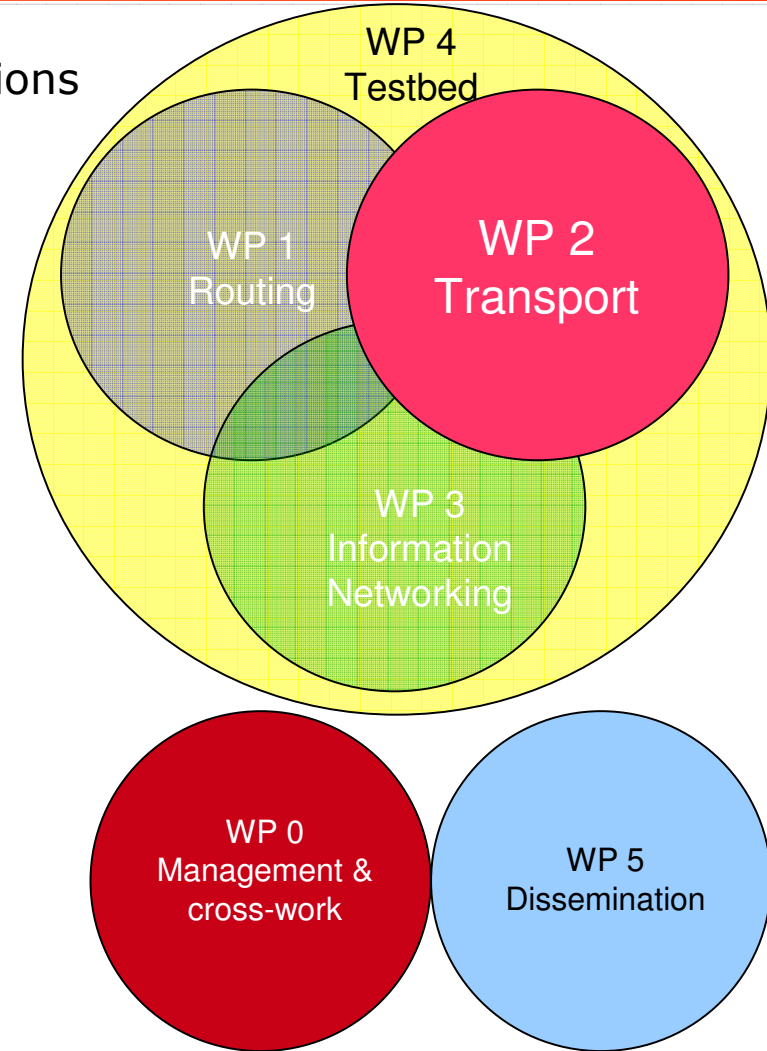
- Start: April 2008
- 50 person years/year
- + SMEs



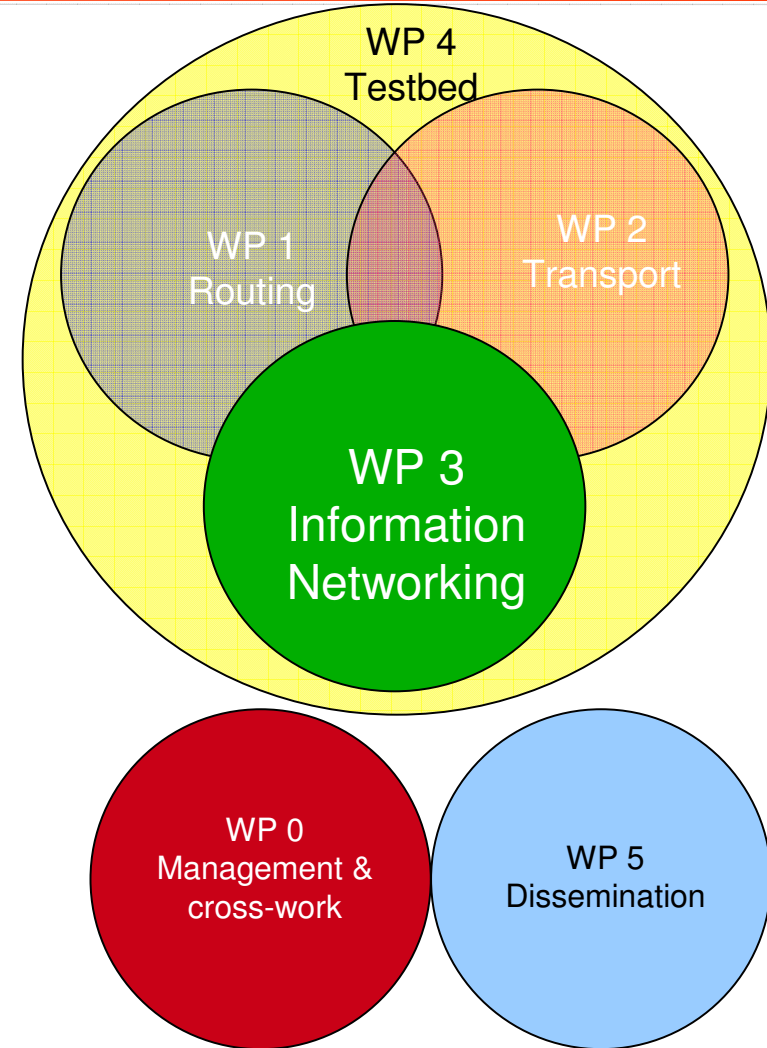
- Routing problem validation
- Short-term solutions
 - Provider clustering
 - Address indirection
 - IRTF
- Long-term solutions
 - Routing in the network of the future (e.g. Ethernet routing)



- Energy-aware Internet communications
- Communications in challenged environments (e.g. DTN)
- Developments in Internet transport
- Policy-based resource management

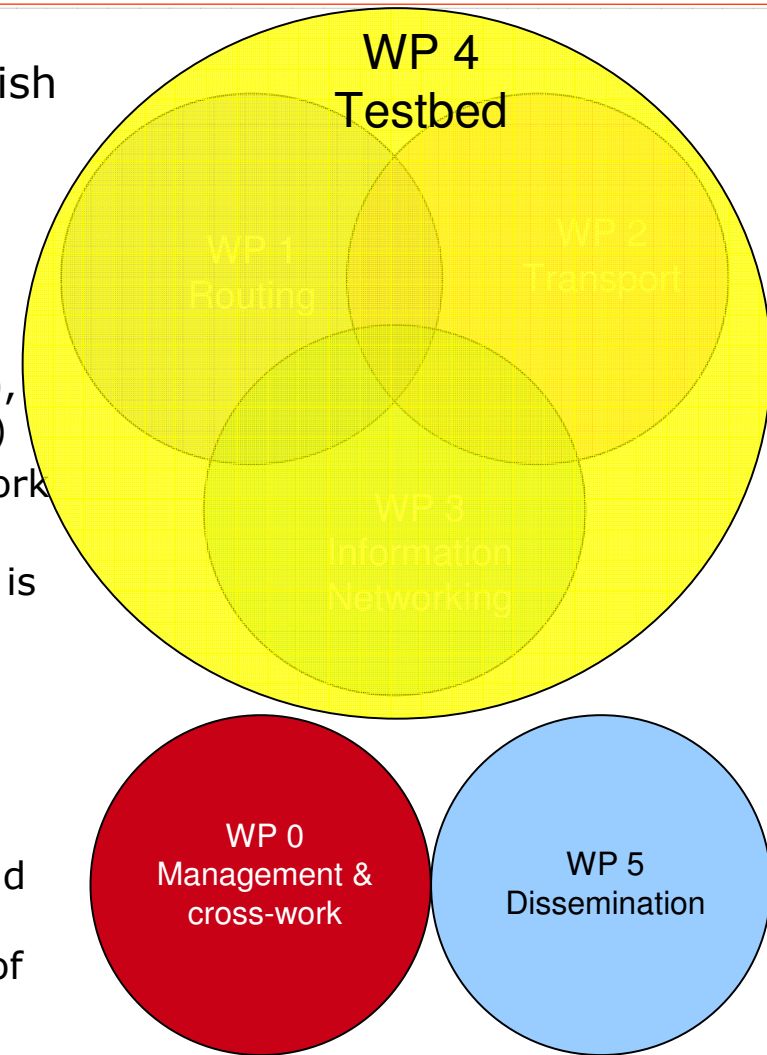


- Key issues
 - Architecture
 - Naming
 - Implementation
 - Performance
 - Security
- Starting points
 - P2P technologies
 - CDN
 - Cooperation with
 - EU FP7 4WARD + PSIRP

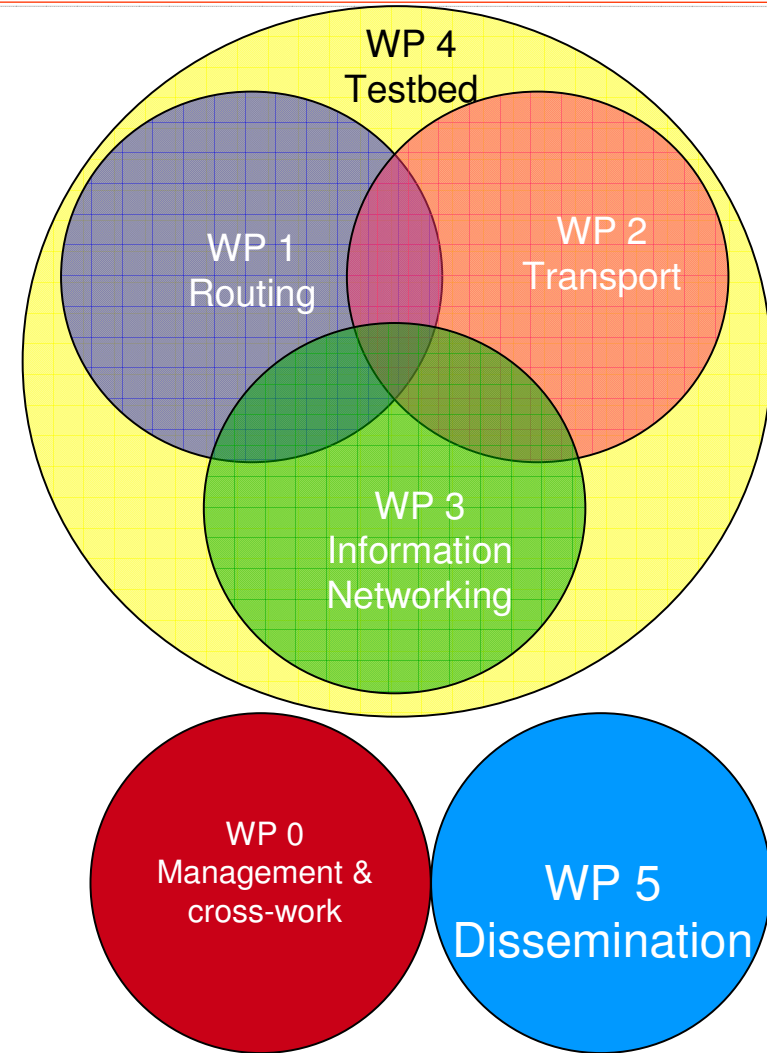


TiViT WP 4 - TESTBED

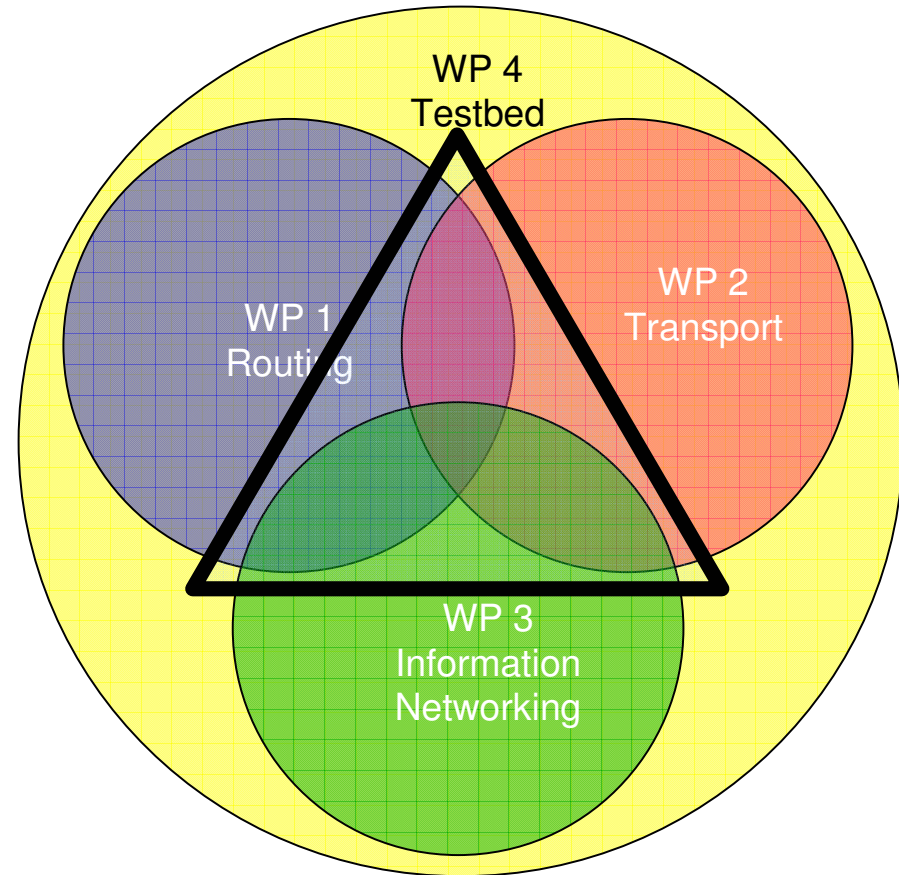
- Testbed Infrastructure based on Finnish national research and education network (NREN) FUNET:
 1. Separate Internet connection (non-firewalled)
 2. Point-to-point lambda connection (usually a CWDM/DWDM wavelength), (all layer 2 encapsulations supported)
 3. Multipoint-to-multipoint layer 2 network (standard Ethernet)
 4. International testbed interconnection is possible using already interconnected fiber/DWDM infrastructure through Europe (up to GEANT2 network and national NRENs)
- International cooperation needs
 - Wider scale testing of routing, e2e and information networking solutions and protocols, as well as interoperability of reference implementations



- Public events
- Publicity
- Education
- International co-operation
- Standardization



- Architectural vision
- Energy-efficiency
- Mobility & multi-homing
- Security & privacy
- Trust
- Socio-economics



“Clean slate” path adopted by the research community

- Starting point: Internet has grown out from its original scope and the previous design assumptions do not hold
- FIND and GENI programs in the US, FP7 programs in Europe and a number of national projects
- 4WARD and PSIRP EU projects

“Evolutionary” approach by standards making bodies

- Incremental improvement to fix pressing problems: routing, addressing, mobility, security, etc
- Ethernet evolution (towards revolution)
- Routing Area
- IETF, IRTF

Emerging

Market

Existing

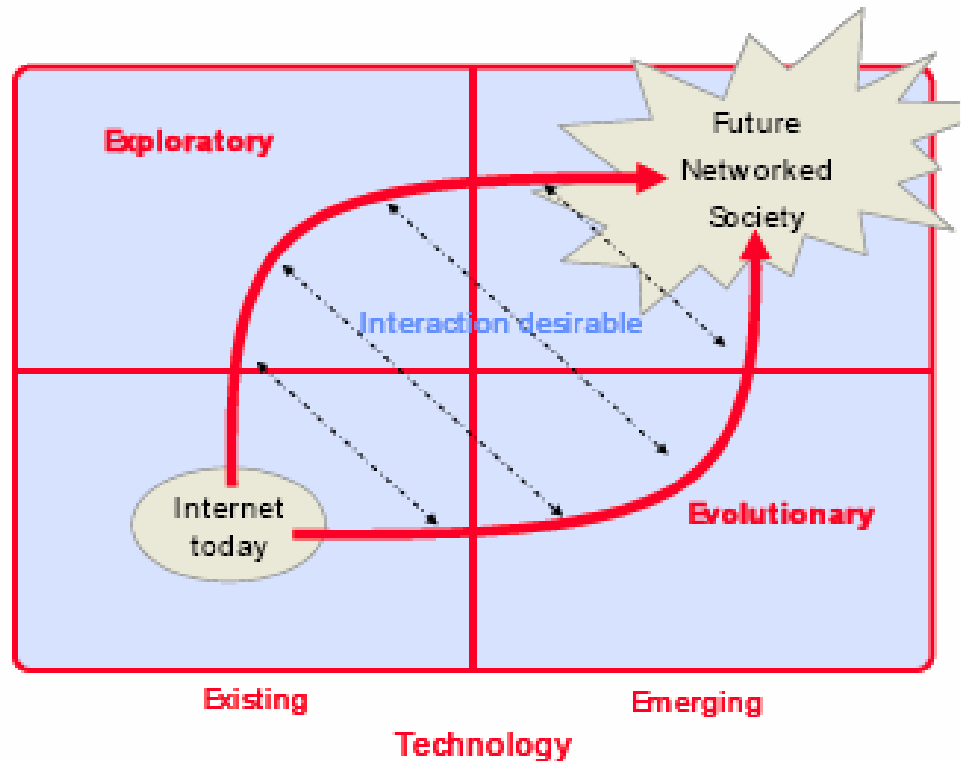


Figure 3: Different paths to the future

Source: Nokia

- Innovative national environment and initiative for Future Internet programme
- From telecommunication paradigm to Internet paradigm
- Long lasting undertaking between industry and academia and aiming to contribute to the Future Internet standardization
- Testing of technology and piloting of usage

- Main topics: routing, transport, information networking
- Short, medium and long-term goals
- Six cross-WP topic areas
- First year ~50 PY

We expect that by becoming early developers and adopters of the Future Internet, Finnish companies and academia will gain immense benefits in new markets and scientific results.

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Thank you!