Research Challenges for Future Internet Usage Areas

from the Perspective of European Research Centres

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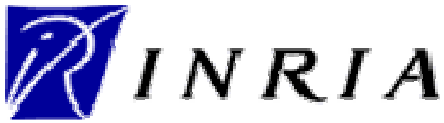
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What is the Future Internet?

- There is no universally accepted definition of the Future Internet
- It will be a socio-technical system comprising:
  - Internet-accessible data sources,
  - Information repositories and services,
- coupled to the physical environment and human behaviour, supporting smart applications of societal importance

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How important is the FI?

- The Future Internet will become a *critical infrastructure* for information exchange for the conduct of business and social interactions

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What will FI scenarios be?

- Vertically integrated within sectors
- Multi-stakeholder and cross-border
- Linking information and physical devices
- Facilitating improved understanding, management and operation of socio-economic activities, spanning the digital and physical worlds

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FI applications will be smart

- Intelligent and able to make choices based on a wide range of information
- Flexible and able to dynamically adapt to the needs of (ever-changing) stakeholders
  - exploiting FI capabilities for rapidly changing connectivity and configuration of facilities and services
- Efficient in their use of resources ('green')

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FI applications may be large-scale

- Technologically inhomogeneous systems spanning organisational and administrative boundaries
  - integrating information from numerous stakeholders
  - coupled to the physical world through sensors and actuators
  - interacting with physical processes and systems, as well as digital process and assets (content)
  - interacting in multi-purpose ecosystems, providing services or other building blocks to each other
  - demanding a high level of user adaptation and self-management

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FI applications will be integrative

- Integrating available and emerging technologies never before combined in a coherent fashion
  - scalable sensor, content delivery and service networks
  - autonomic management of connectivity, devices and services
  - context awareness for user and other physical interactions
  - content awareness for data communication and processing
  - on-the-fly composition of services and other resources

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The Internet is evolving

- Governance objectives have changed
  - competition as well as co-operation
- Connectivity is now a commercial activity (ISPs)
  - new service models
- Trust between users has reduced dramatically
- Developers are now concerned with emergent applications for potentially competing stakeholders
- Societal and legal aspects are increasingly important for businesses, governments and citizens

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Issues for the Core Platform

- Largely common across applications and sectors
- Technologically converging networks, services, content and devices
- Closer coupling of digital and physical worlds
- Increased dependence on distributed information
  - controlled by independent parties
  - governed by both markets and regulation
- A critical infrastructure for information exchange
  - the consequences of failure impact the real world

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Core Platform Research Challenges

- Emergent systems engineering and compliance
  - how to design Future Internet systems to meet requirements, given that they will be created and evolve dynamically 'on demand' with no overall designer?
- Operational risk management
  - how to ensure in real time that systems with no overall controller will operate in a safe and acceptable manner, including interactions with the physical world, considering both autonomic and semi-autonomic adaptation processes?
- Turning information into value
  - how to make information accessible to applications that convert that information into value, and how to preserve this value over long timescales?
- Socio-economic and user acceptance
  - what platform capabilities are needed to ensure that users and society will accept the Future Internet and use it beneficially?

See Position Paper at http://eprints.ecs.soton.ac.uk/21086/

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FI PPP Challenges

- The FI PPP will be a disruptive technology programme with several competing drivers
  - technical vs socio-economic
  - horizontal vs vertical
  - research vs development
  - exploitation vs efficiency
  - research focus vs durability
- The FI PPP must balance innovative research with robust outputs for realistic open trials and the potential for commercial exploitation

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Leveraging Previous Investments

- The FI PPP can build on previous investments from national and EC programmes
- Generic enablers, infrastructure and platform capabilities
  - autonomic networks
  - cross-layer QoS management
  - dynamic security and dependability
  - federated information modelling and distribution
- The catalogue of capabilities and enablers is almost complete

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Existing Pilots with Potential International Synergy on Smart Health

- Networks across hospitals to test services in the hospital and to the different patient homes
- Biomedical technology centres including different organs (such as brain) testing environments and body area networks sensors
- Service platforms for patient information delivery through mobile and fixed networks
- Virtual environments labs with 3D representation capabilities

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Existing Pilots with Potential International Synergy on Smart Energy

- Houses as labs for energy sustainability and efficiency testing
- Experimental facilities for simulating energy networks
- Laboratories for Green energy testing

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Existing Pilots with Potential International Synergy on Smart Energy

- 3D and Ultra-high definition TV labs (including home environments)
- Usability and quality of experience labs
- Networks research facilities

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Existing Pilots with Potential International Synergy on Smart Transport Mobility

- Cities, roads and railways as testbeds for technology and users acceptance including vehicles, networks (mostly wireless), users, etc
- Simulators for networks and traffic management

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Existing Pilots with Potential International Synergy on Smart Environment Utilities

- Large wireless sensor networks testbeds with multiple sensors
- Environment usage testbeds for different applications (agriculture, cities pollution, etc.) involving networks and users

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Conclusion

- The role of Research Centres is to help to address the applied research challenges
- The FI PPP will build on the enablers and capabilities
  - integrating them into a converged architecture based on open standards
  - leverage previous investments to create flexible platforms that deliver cost-effective testbeds, and
  - enable socio-economically practical deployment of 'smart' applications on a Future Internet

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