From The Internet of ??? To The Future Internet

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Outline

- **From RFID…**
  - Single to shared markets
  - Specific challenges
- **…to overall challenges for the Internet…**
  - Impairing solutions and our thinking
  - On tussle
- **…to a vision for tomorrow**
  - Tussle networking and its challenges
- BT's efforts in this space

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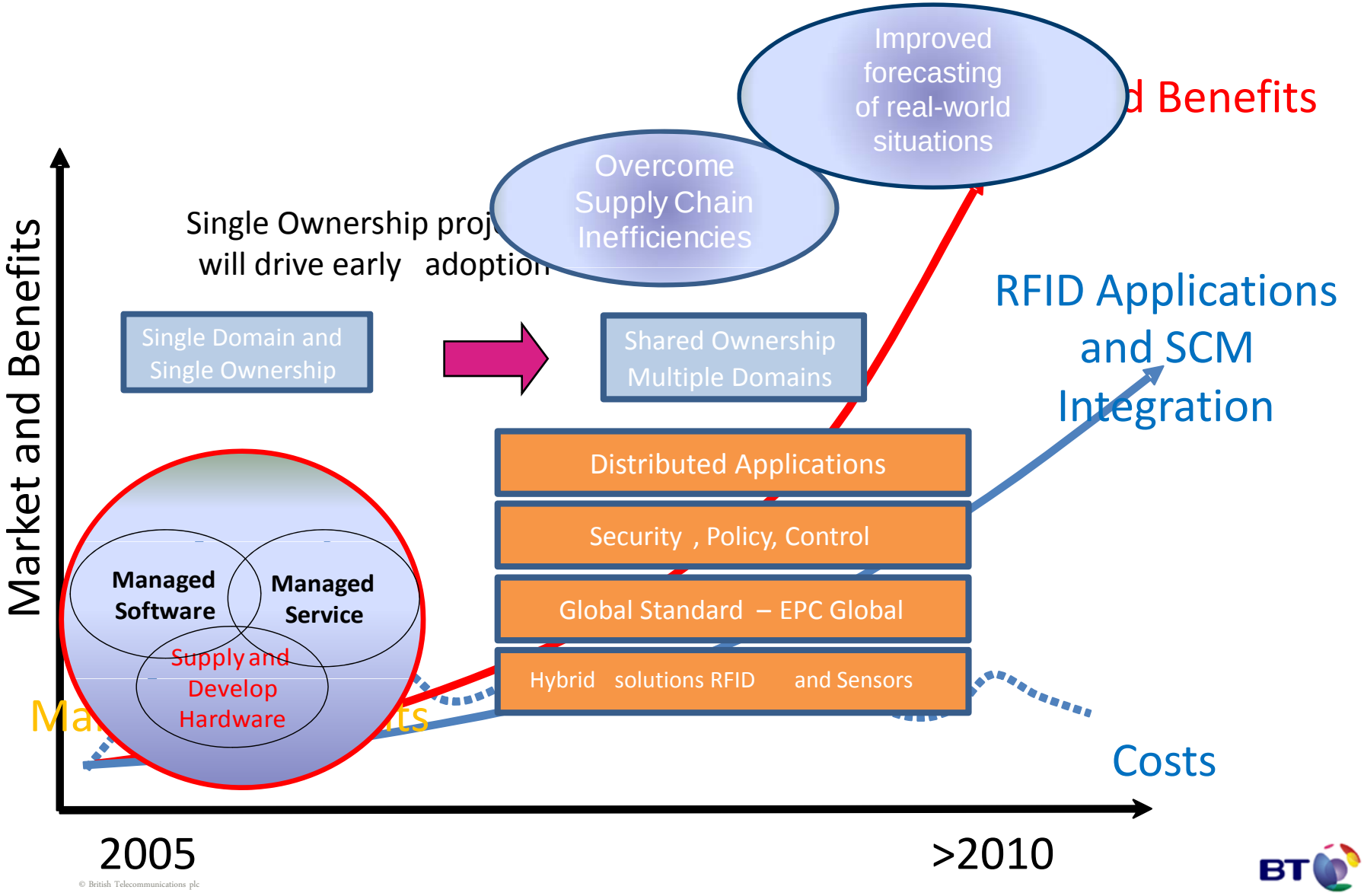
RFID: From Single to Shared Markets



Challenges along the Way

- Security
  - Reader and tag security
  - Communication security
- Discovery
  - Integrating policy-based release of data
  - Ensuring confidentiality & authenticated access
- Policies
  - How to enable true cross-domain collaboration?
  - Expressiveness vs. simplicity
  - Enforcement
- Scalability
  - We've just seen the start of it!
- …and many more

RFID Security Framework
(e.g., FP6 BRIDGE project)
- Enabling controlled release of data
- Main components:
  - EPCIS/DS
  - readers
  - tags

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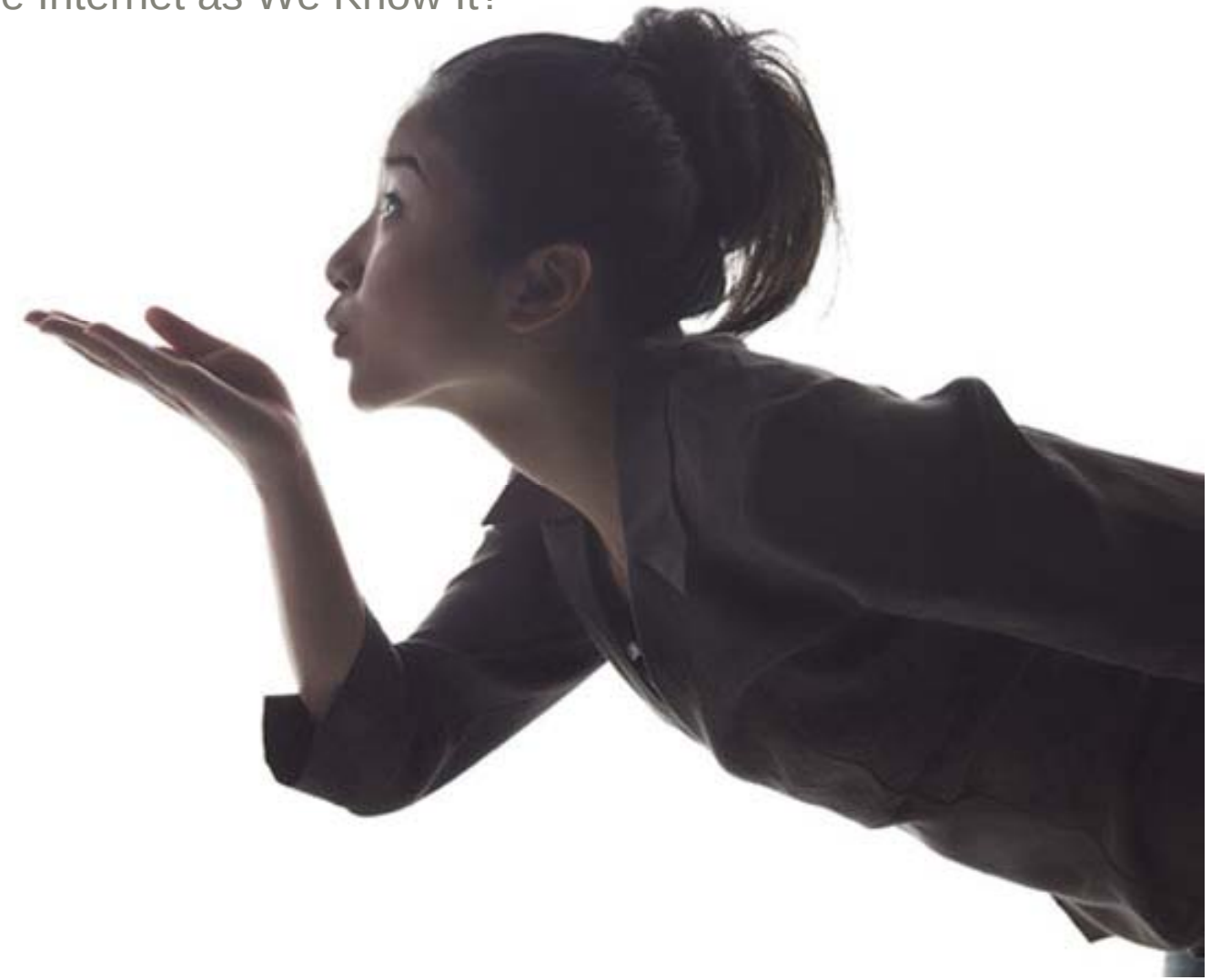
The Bigger Picture

What Does it Mean to the Internet as We Know It?

Or

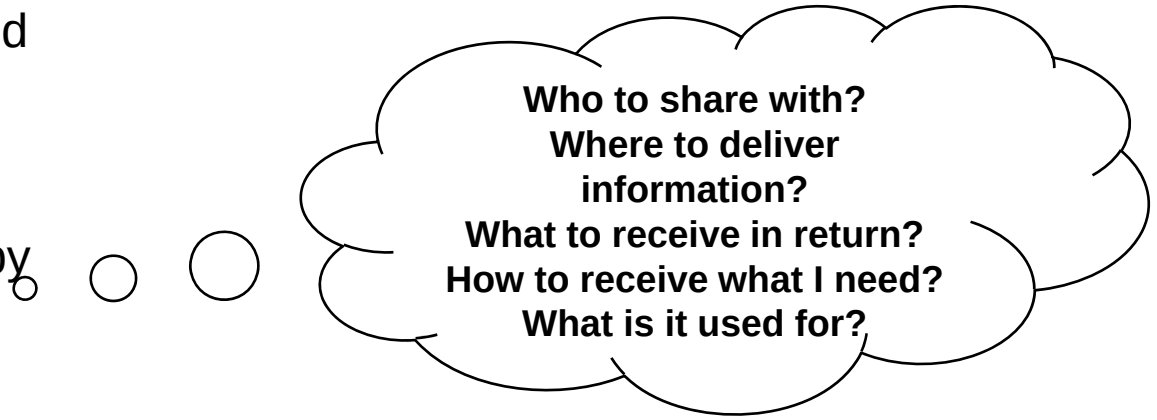
Is SOA enough?



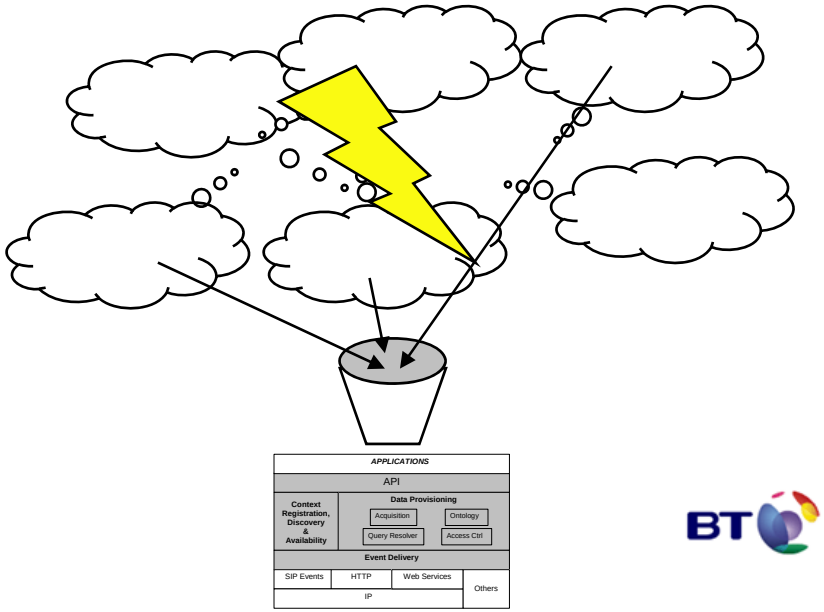
Problem Space: Communication and Its Surrounding Concerns

Communication is essentially about production, retrieval and consumption of information

Communication is delimited by concerns



Concerns of individuals, organizations, communities, and societies could lead to conflicts (tussles)



Concerns are represented in systems & solutions as constraints

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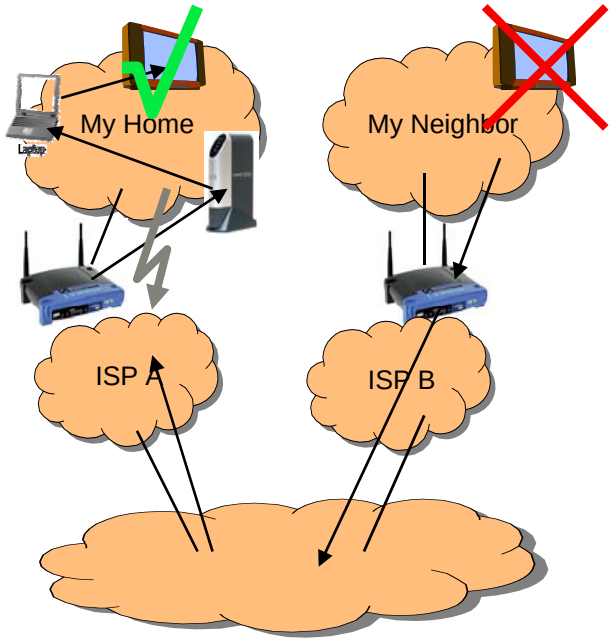
Problem Today: Impaired Networking

Example:

Showing my photos at my neighbour's house



Problem here:

- End users don't comprehend the concept of domains & network boundaries
- Intentions of users not well exposed to solution, conflicting with defined security concerns (My Home firewall blocks all requests from outside)

Fundamental Problem

Communication is impaired by implicitly embedding concerns into architectures

-> designing an architecture is a way of mediating conflicting concerns of players

-> conflict resolution at design phase

Observations:

- Lock-in of different kinds, e.g., single *device lock-in*, *operator lock-in*, *frequency lock-in*, *network lock-in*, *identity lock-in*
- Appearance of parallel, yet often similar architectures that are difficult or impossible to navigate across
- Increase of complexity and maintenance of parallel architectures

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Parallel Architecture Thinking also Impairs Our Thinking Forward

Many views of the Future Internet:

- The Internet of Things
- The Internet of Services
- The Internet of Media
- The Internet of put-your-favourite-word-here

-> driven by interest groups, immersed in their concerns and resulting tussles

Interesting question is:

How can we go from the Internet of whatever to the (real) Future Internet?

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Solution for Tomorrow: Tussle Networking

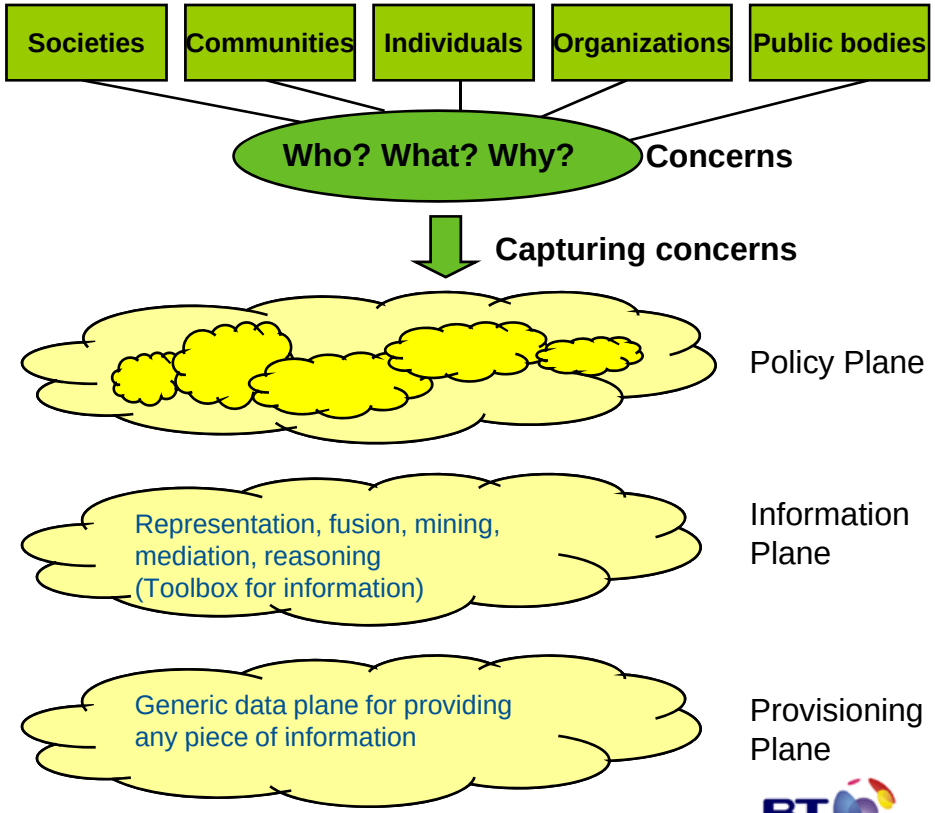
Application-specific solutions can always be found!

BUT: A fundamental change is required to fix this impairment problem overall, questioning fundamentals of the Internet (e.g., IP)

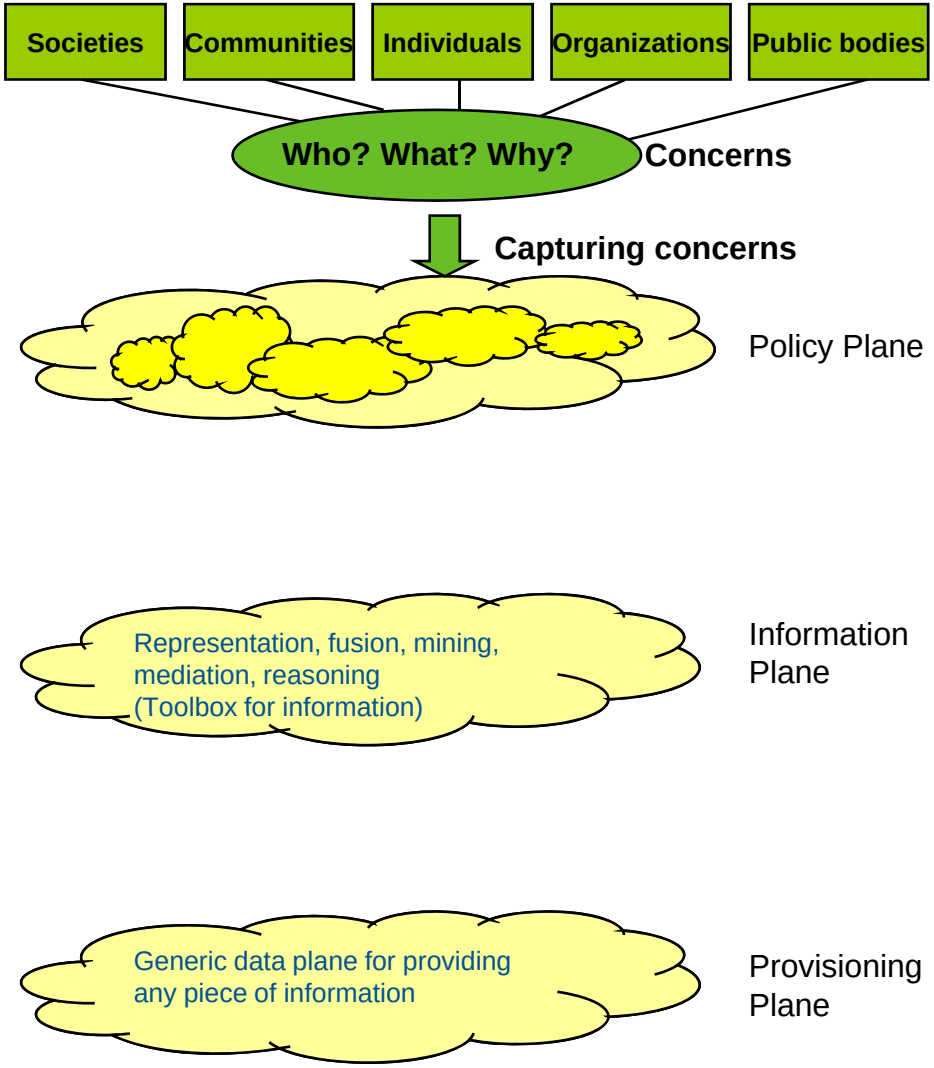
Expose concerns as explicit policies, executed within a single architecture

-> Minimize parallel architectures through conflict resolution at runtime

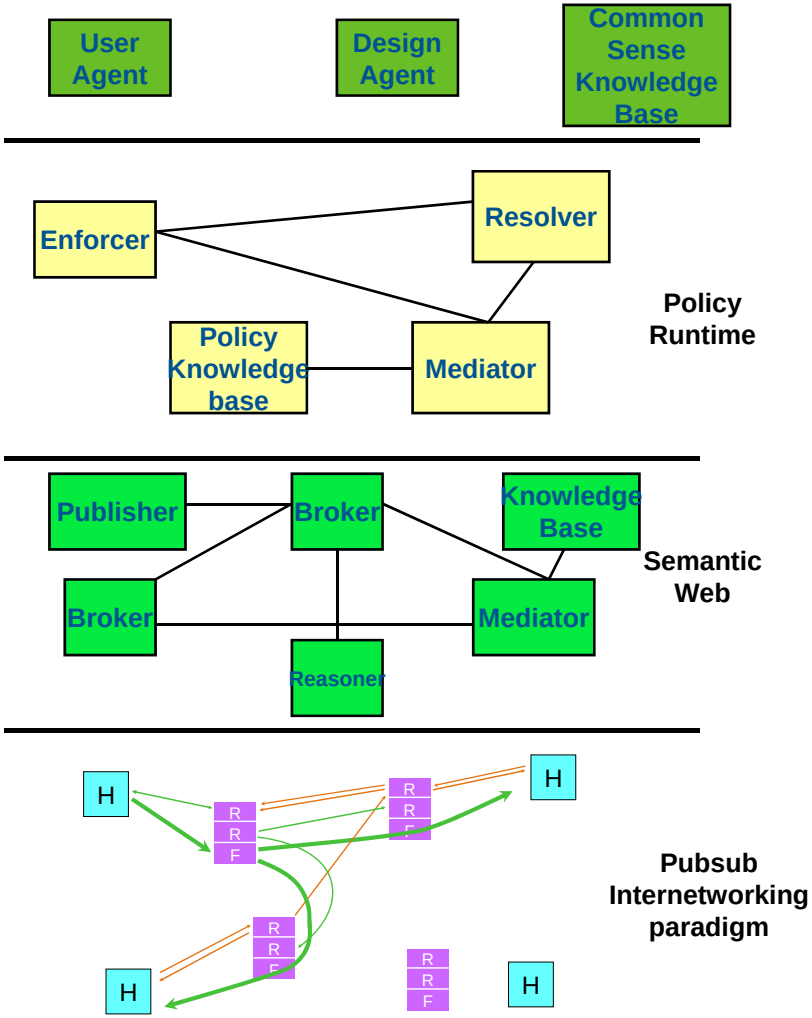
- **Resolved through policy mediation, negotiation & enforcement**
- **Enables trusted collaboration across industries in runtime**
- **Instantaneous reconfiguration according to needs**



A Post-Modern World: The Tussle Internet



Architectural Vision



Architectural Implementation

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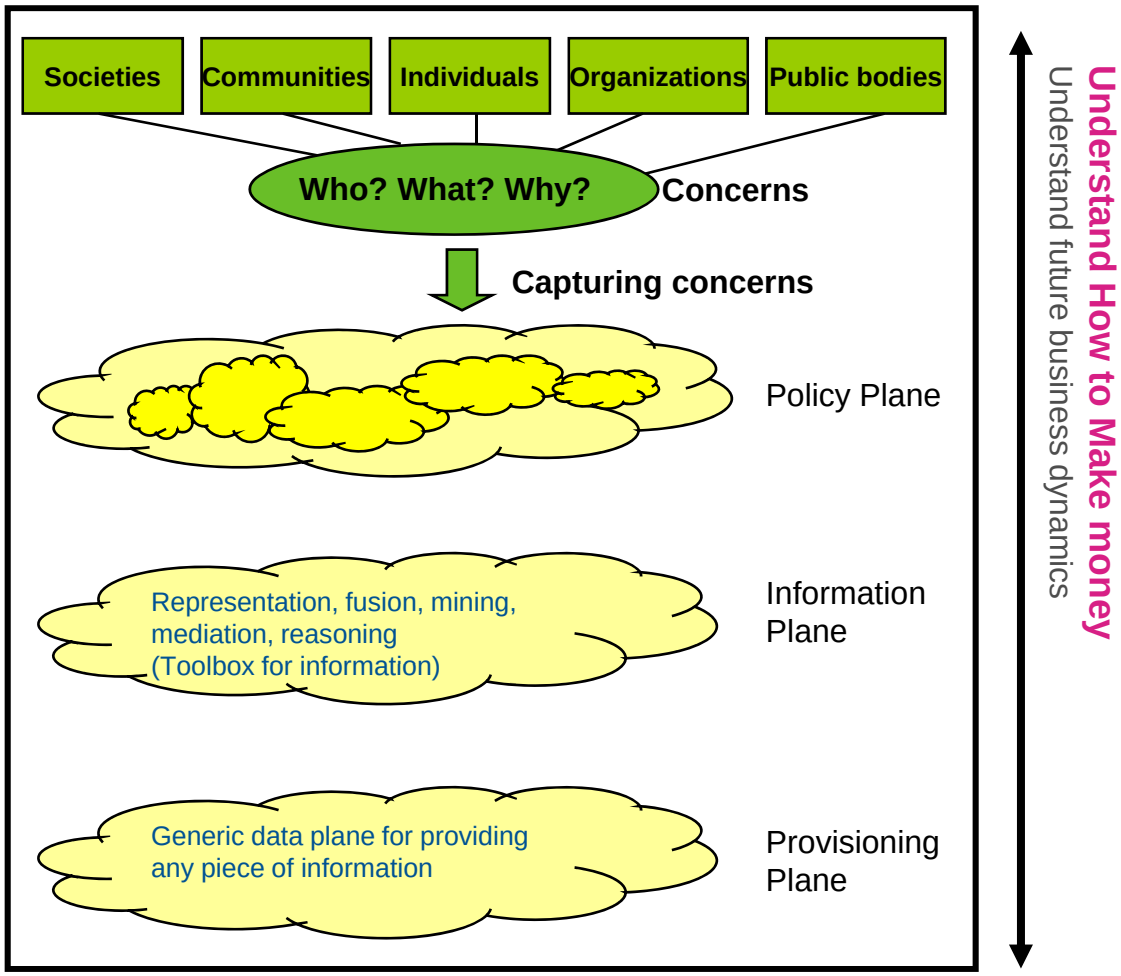
Challenges to Overcome

- **Capture concerns**
  - How do end users participate?
  - How to capture concerns I might not even know of?
  - How to capture concerns embedded in mechanisms of regulation & standards
- **Express concerns**
  - Find balance between expressiveness and simplicity
  - Enable delimitation, mediation, and negotiation of conflicts
- **Navigate the information maze**
  - Representation and mediation of differences
  - Mine and fuse information, given certain policies
- **Build the provisioning plane**
  - Centred around and optimized for information delivery
  - Break with IP foundation (endpoints)



Most importantly: Engage the wider Internet community to work towards the required fundamental changes!

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BT's Role in the Future Internet Research

BT has a long-standing tradition in research and development

Active in many activities towards the Future Internet:

- Collaborative projects within EU FP6 & FP7 on networking level
  - BRIDGE: working on RFID solutions that will push us towards shared markets
  - EIFFEL: Caretaker (partner) and one of the main contributors
  - Trilogy: renewing the Internet routing architecture
  - PSIRP: replacing IP with pubsub-oriented internetworking layer
  - Onelab2: experimental efforts to showcase and validate
- Many more in information and policy space
- Many research consortia, e.g., CFP@MIT, CMI@Cambridge,…
- Nationally funded projects

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The Mantra Driving our Efforts

The best way to predict the future is to invent it!

(Alan Kay)

The best way to invent the future is to live it!

(yours truly)

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