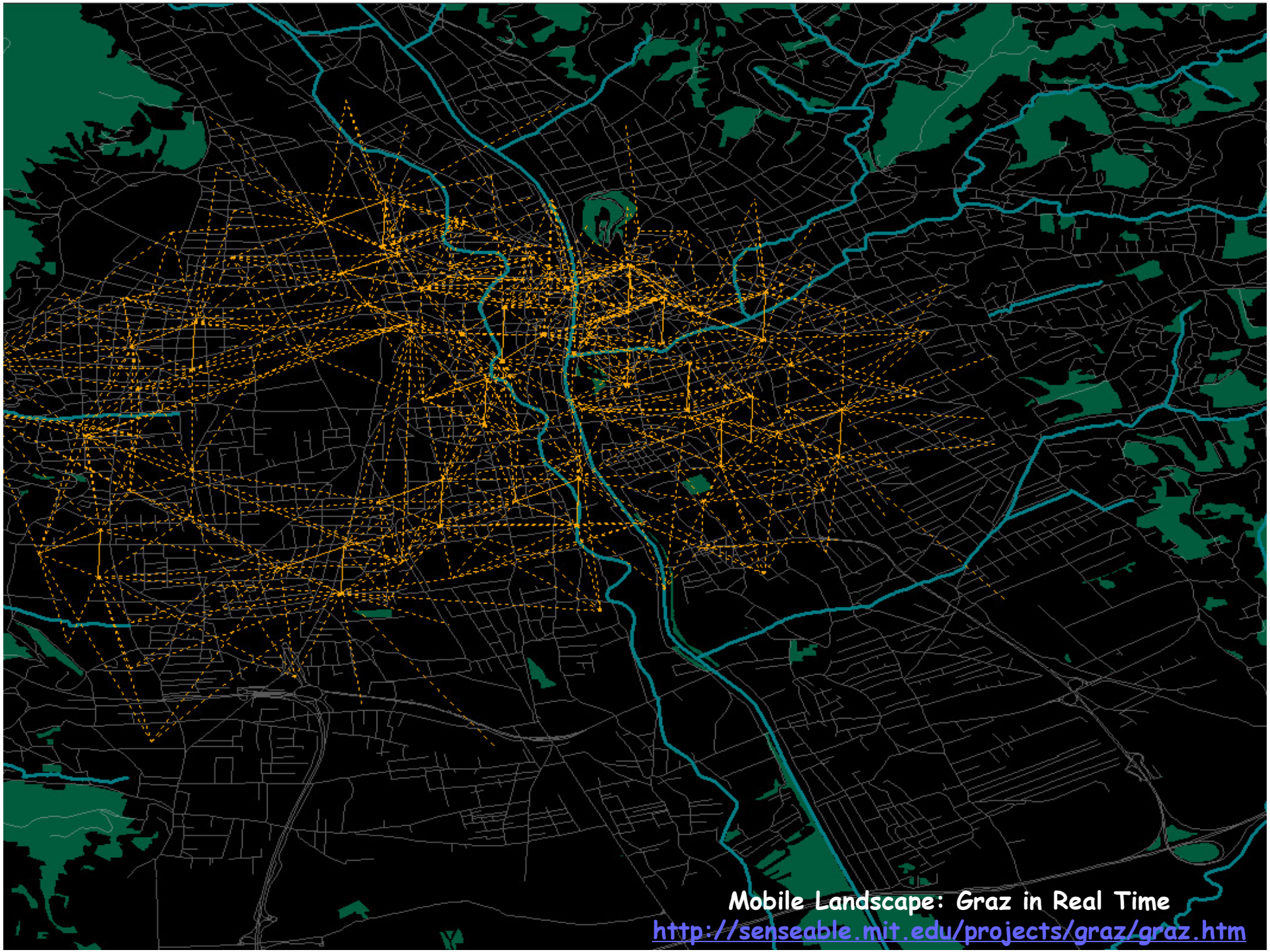
Dipartimento
Elettronica
Informazione

The Future of ICT Services

Maurizio Dècina
Politecnico di Milano

ICC 2006 ISTANBUL
June 12, 2006

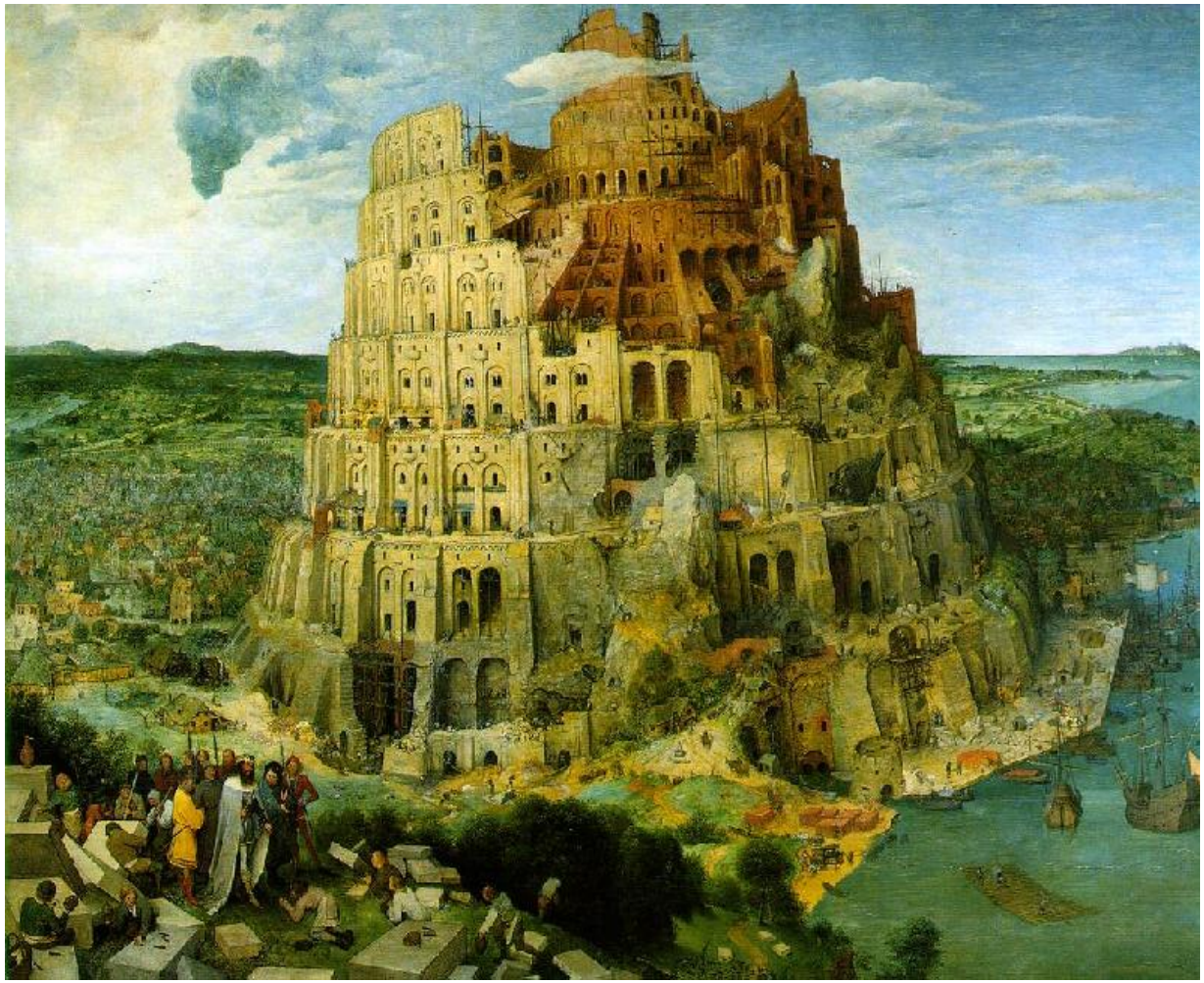

Mobile Landscape: Graz in Real Time
http://senseable.mit.edu/projects/graz/graz.htm

Topics

- Future of Information Services
- Future of Networked Services
- Convergent Services
- Competition for Information Services

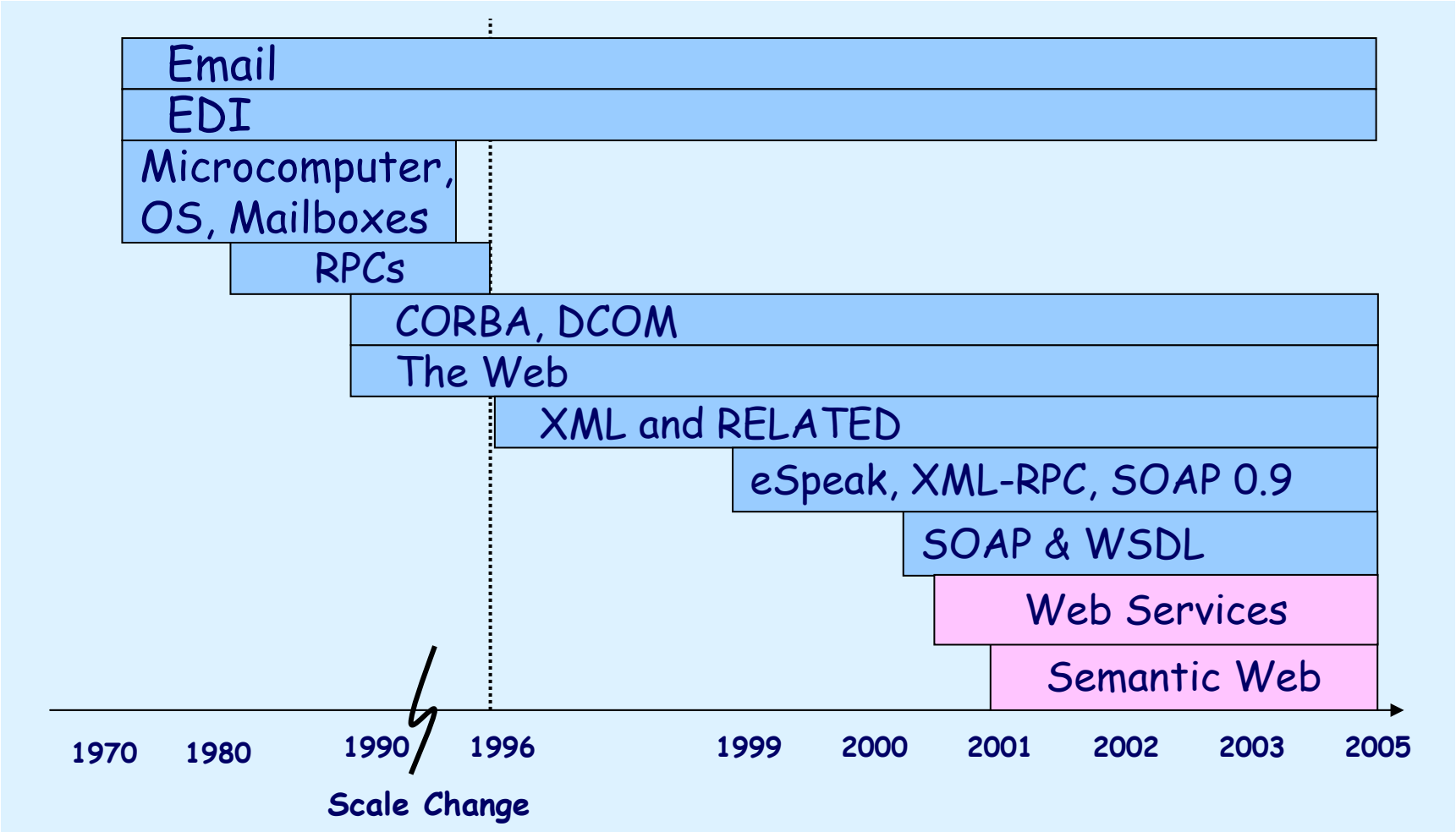
The Service Interoperability Gap

Dipartimento
Elettronica
Informazione



An History of Interoperability

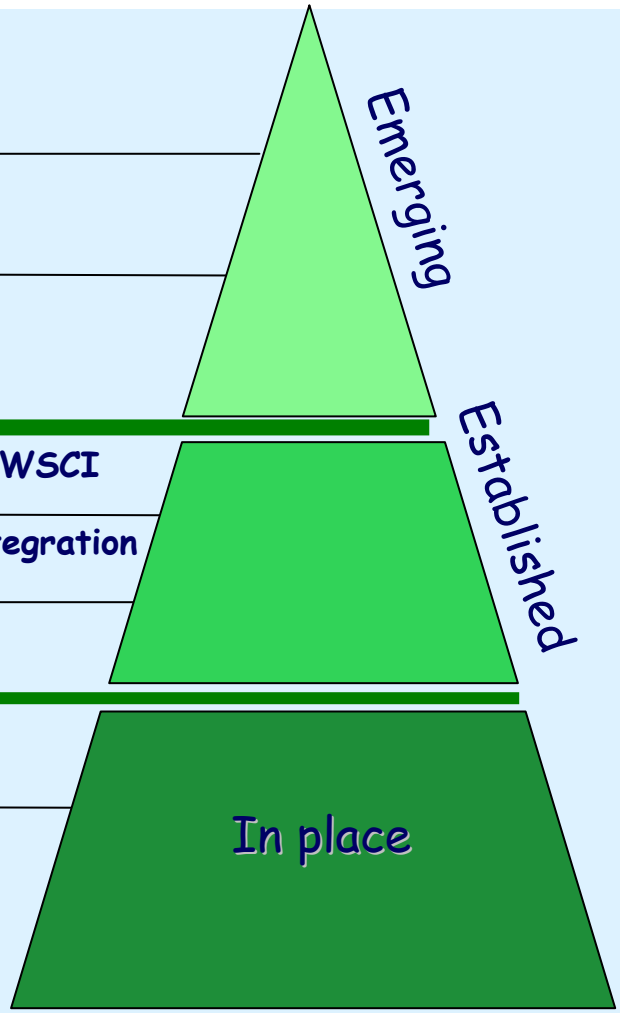
Dipartimento
Elettronica
Informazione



Web Services Standards

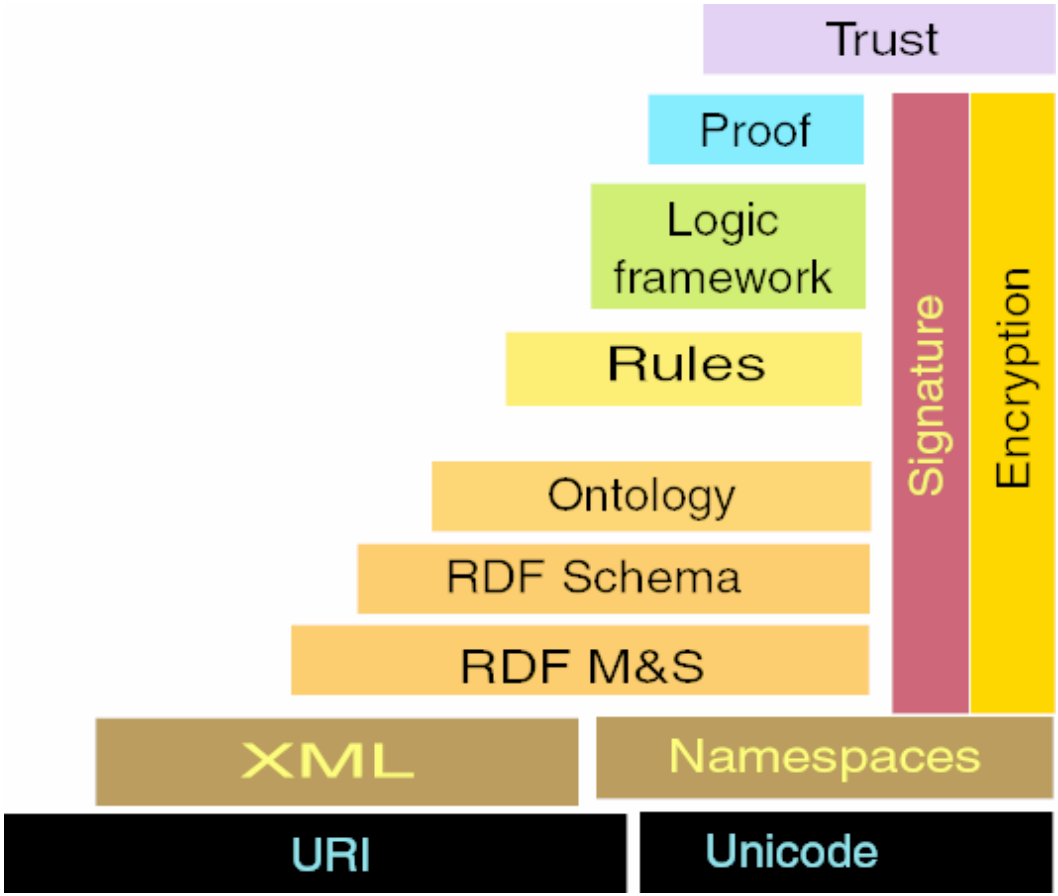
Dipartimento
Elettronica
Informazione

Identifying	Liberty, Passport
Building Trust	WS-Security, SAML, XRML
User Interface	Web Services for Remote Portals (WSRP) Web Services User Interface (WSUI)
Workflow/BPM	Bus.Proc.Execution Lang. (BPEL4WS), BPML, WSCI
Search & Find	UDDI - Universal Description Discovery & Integration
Description	WDSL - Web Services Description Language
Message	SOAP - Simple Object Access Protocol
Format	Extensible Markup Language (XML)
Transport	Common Internet protocols. (e.g., TCP/IP, HTTP)



Berner-Lee's Semantic Web Architecture

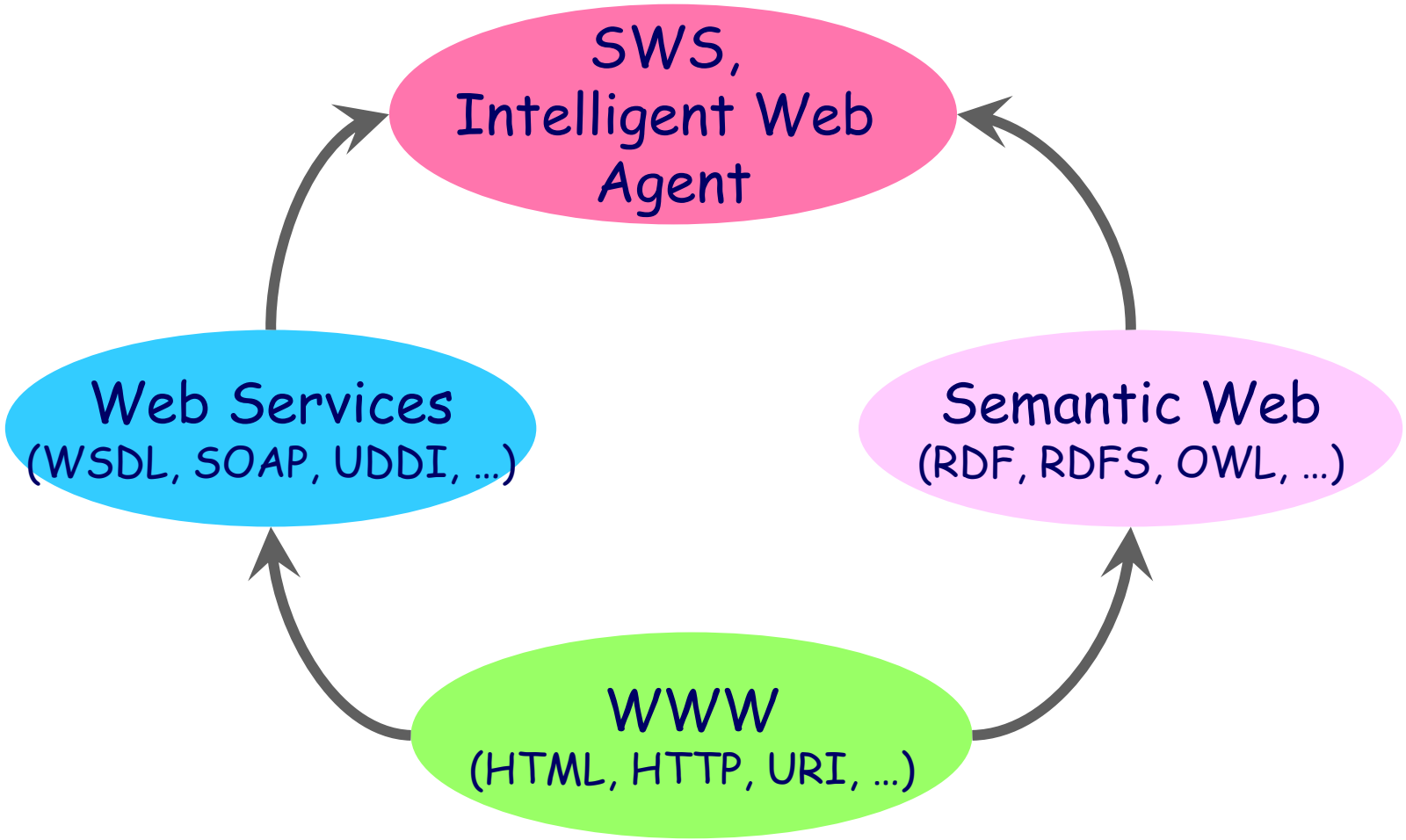
Dipartimento
Elettronica
Informazione



Tim Berners-Lee http://www.w3.org/2002/Talks/09-lcs-sweb-tbl/

Semantic Web Services (SWS) & Intelligent Web Agents

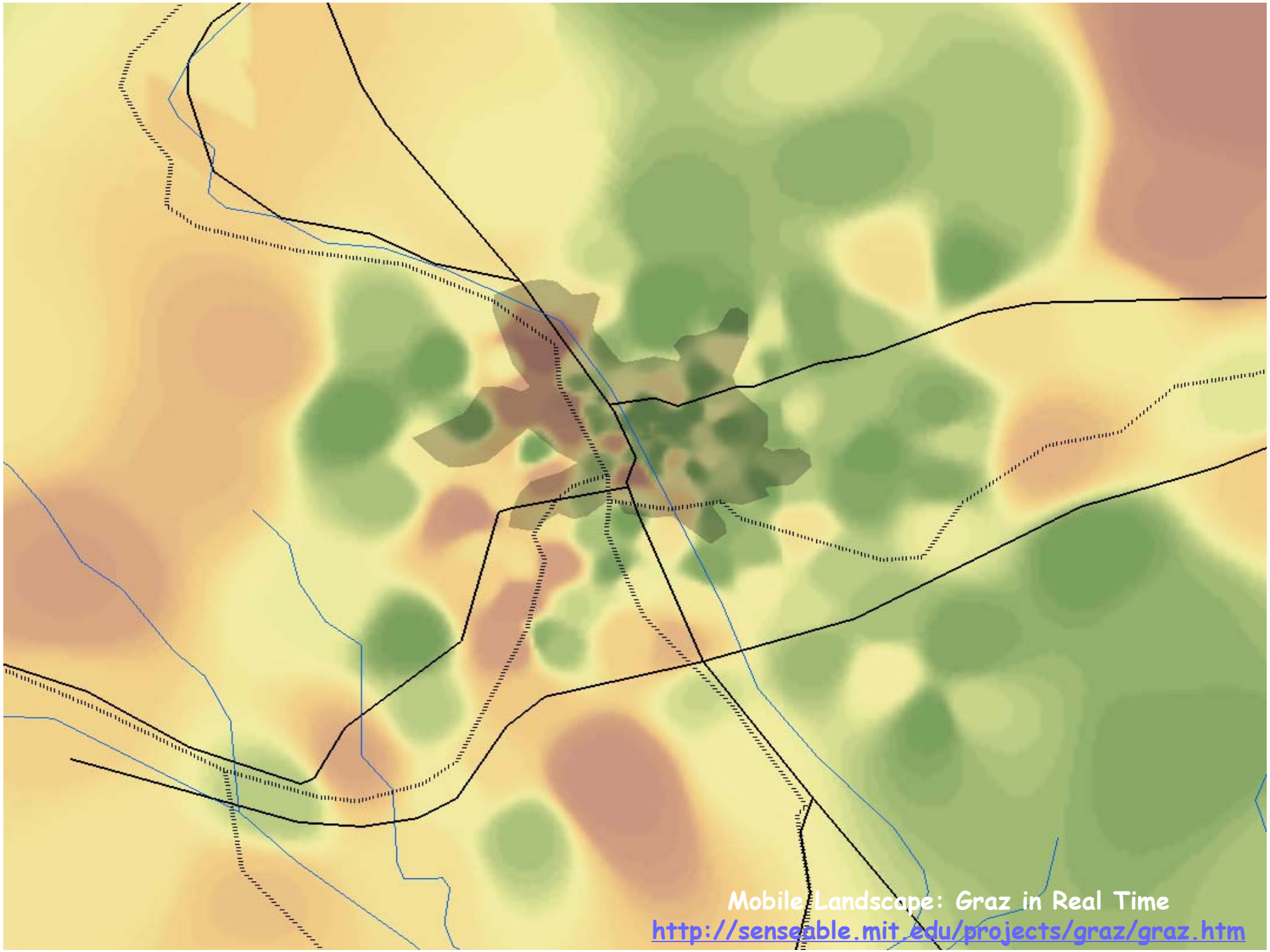
Dipartimento
Elettronica
Informazione



Service Oriented Architecture
Automating Electronic Business

<table>
<tr><td colspan="5">UDDI</td><td>ebXML Registries</td><td>Discovery</td></tr>
<tr><td colspan="5"></td><td>ebXML CPA</td><td>Contracts and agreements</td></tr>
<tr><td>OWL-S Service Model</td><td colspan="3">BPEL4WS</td><td>BPML</td><td>Process and workflow orchestrations</td></tr>
<tr><td colspan="2"></td><td colspan="3">WS-AtomicTransaction and WS-BusinessActivity</td><td>BTP</td><td>QoS: Transactions</td></tr>
<tr><td colspan="2" rowspan="2">OWL-S Service Profile</td><td>WS-Reliable Messaging</td><td>WS-Coordination</td><td rowspan="2">WSCI</td><td rowspan="2">ebXML BPSS</td><td>QoS: Choreography</td></tr>
<tr><td>WS-Security</td><td>WSCL</td><td>QoS: Conversations</td></tr>
<tr><td colspan="2" rowspan="2">OWL-S Service Grounding</td><td rowspan="2">WS-Policy</td><td colspan="2" rowspan="2">WSDL</td><td rowspan="2">ebXML CPP</td><td rowspan="2">QoS: Service descriptions and bindings</td></tr>
<tr><td>OWL</td><td>PSL</td></tr>
<tr><td>RDF</td><td colspan="4">SOAP</td><td>ebXML Messaging</td><td>Messaging</td></tr>
<tr><td colspan="6">XML, DTD and XML Schema</td><td>Encoding</td></tr>
<tr><td colspan="6">HTTP, FTP, SMTP, SIP, etc.</td><td>Transport</td></tr>
</table>

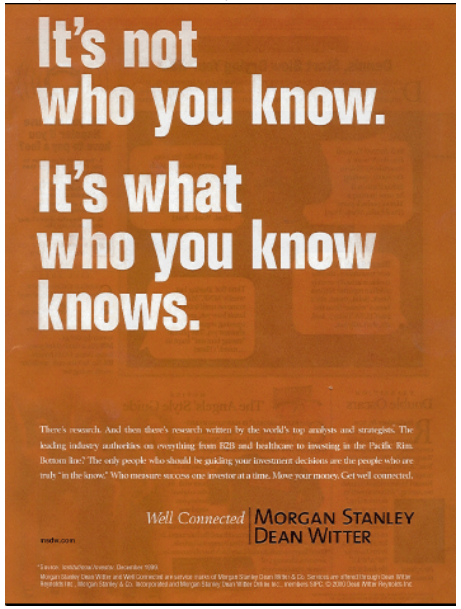
Source: Singh & Huhns, 2005


Mobile Landscape: Graz in Real Time
http://senseable.mit.edu/projects/graz/graz.htm

Social, Cognitive and Knowledge Networks

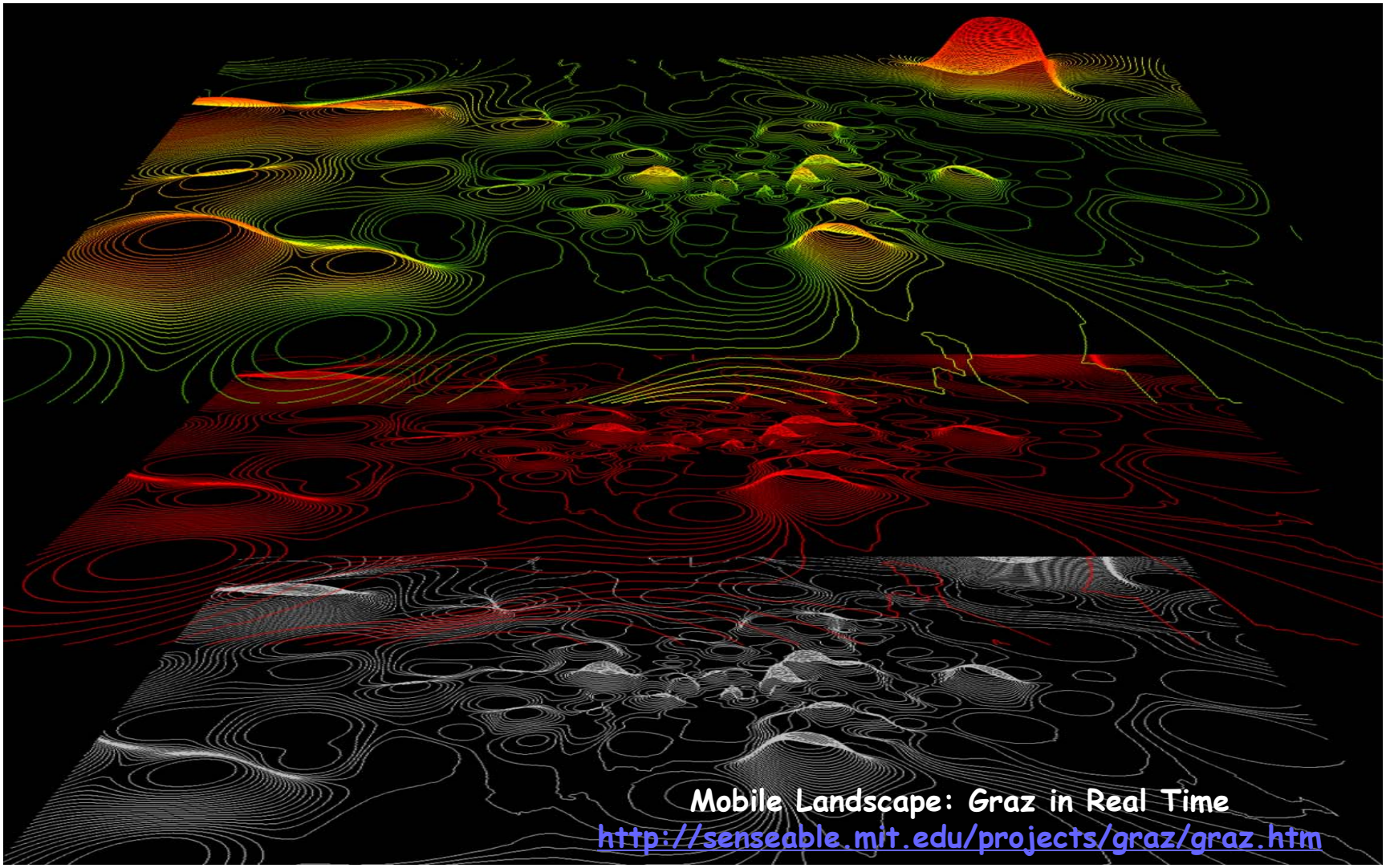
- Social Networks
  - Its not what you know, its who you know
- Cognitive Social Networks
  - Its not who you know, its who they think you know
- Knowledge Networks
  - Its not who you know, its what they think you know

Cognitive Knowledge Networks



Networking at Multiple Layers

Dipartimento
Elettronica
Informazione



Multilayer Networks

5	Application Agents Middleware & Applications: SOA & SWS			
4	Grid Networks , Content Delivery Networks *Content-Based Routing* Peer-to-Peer Networks Active Networks: XML Routing			
3	*IP Routing* IP Networks MPLS, Wireless Mobility			
2	Wireless Sensors Networks	Wireless Ad Hoc Networks	Ethernet Networks *RPR, MPLS, **WiFi, WiMAX***	TDM+ Networks *ISDN, ATM, **GSM, UMTS, HSDPA***
1	Radio, Optics, MEMS,Sensors Power	Radio, Optics, Vehicular & Personal	Copper, Radio, Fibre, SDH & WDM Media Interconnections	

e2e-QoS: Performance, Reliability, Availability, Privacy, Security, Maintainability, ...

Multilayer Discovery and Routing Protocols

- Peer-to-Peer Networks (DHT, Chord, CAN, Pastry, ..)

- Wireless AD-Hoc Networks (AODV, DSR, TORA,..)
- Wireless Sensor Networks (GPSR, Geometric Routing, LEAC,..)

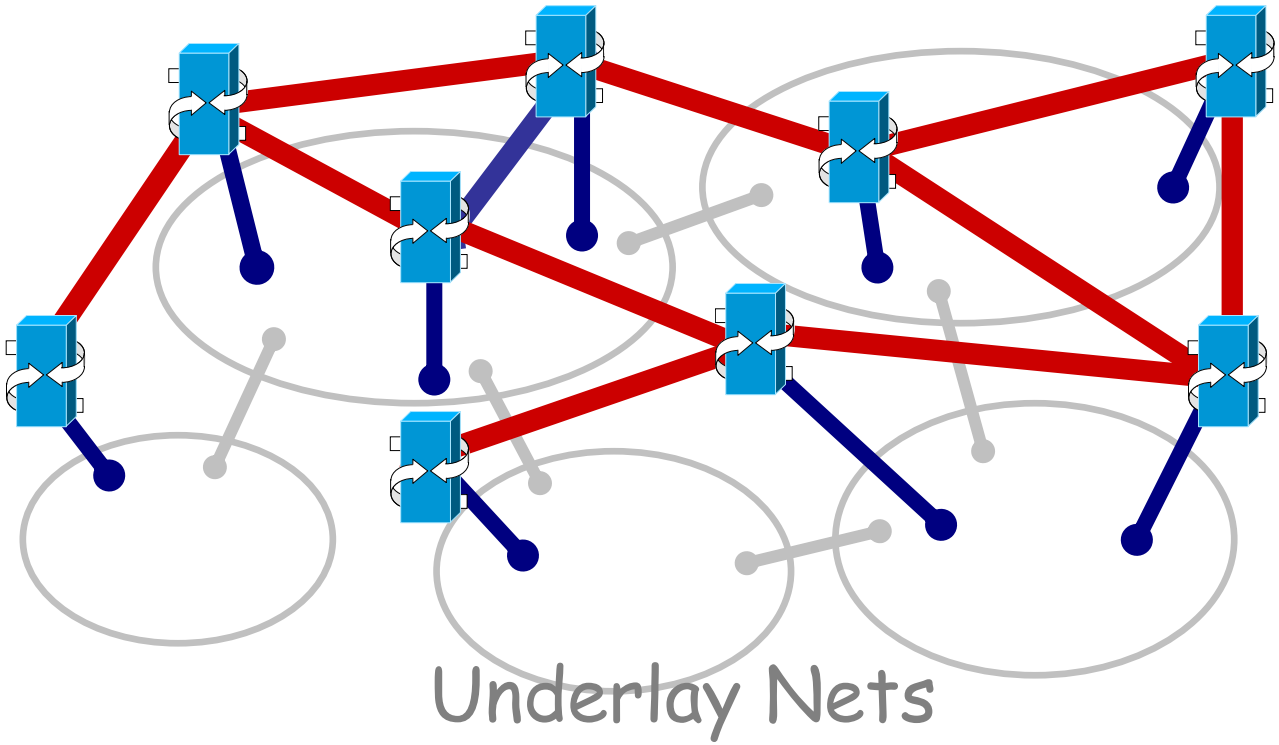
- Wireless IP Networks (Mobile IP, Radius/Diameter, ..)
- IP Networks (RIP, OSPF, BGP,…DVMRP, MOSPF,..MPLS,)
- Ethernet Networks (RPR, MPLS,..)

- Cellular Mobile Radio Networks (HLR, VLR, BSC)
- TDM telephony Networks (HDR, NHDR)

e2e-QoS: Performance, Reliability, Availability, Privacy, Security, Maintainability, ...

Overlay Networks

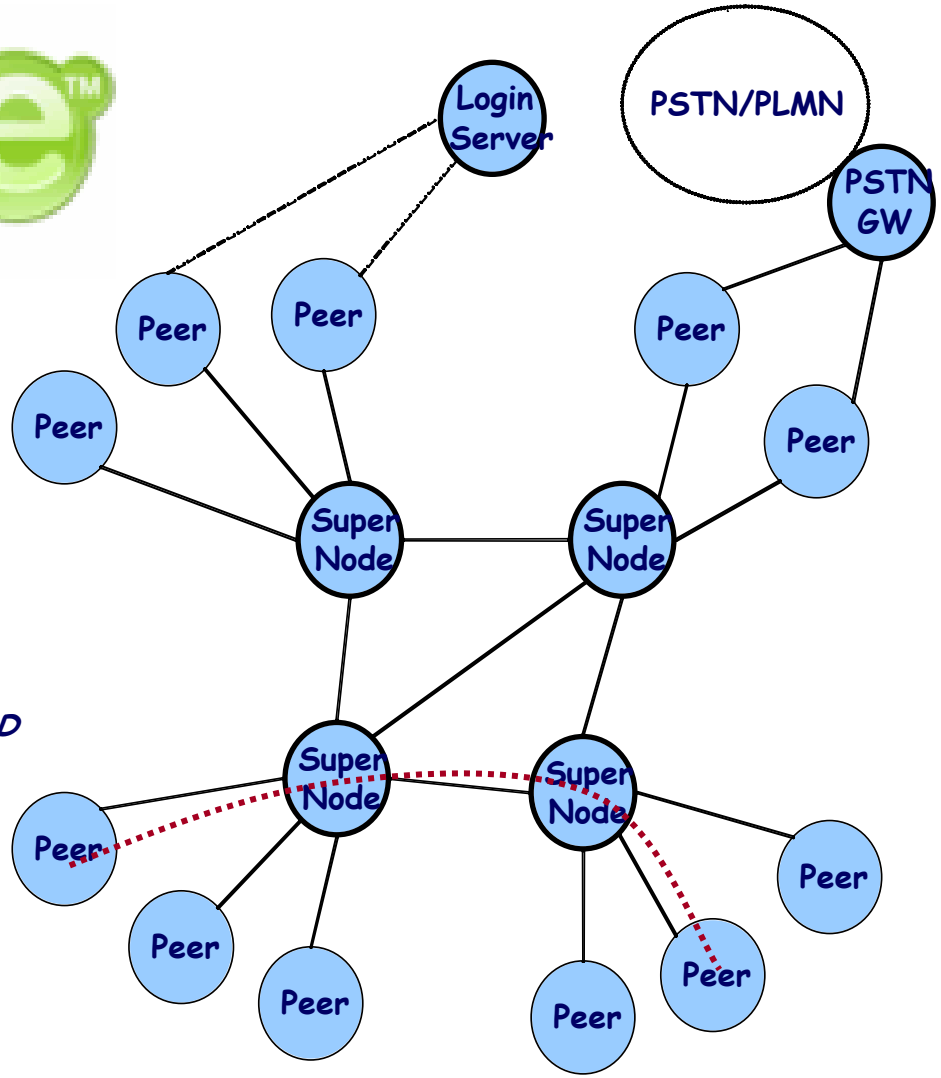
Grid Networks
Content Delivery Networks
Peer-to-Peer Networks
Active Networks: XML Routing



Skype Networking Architecture

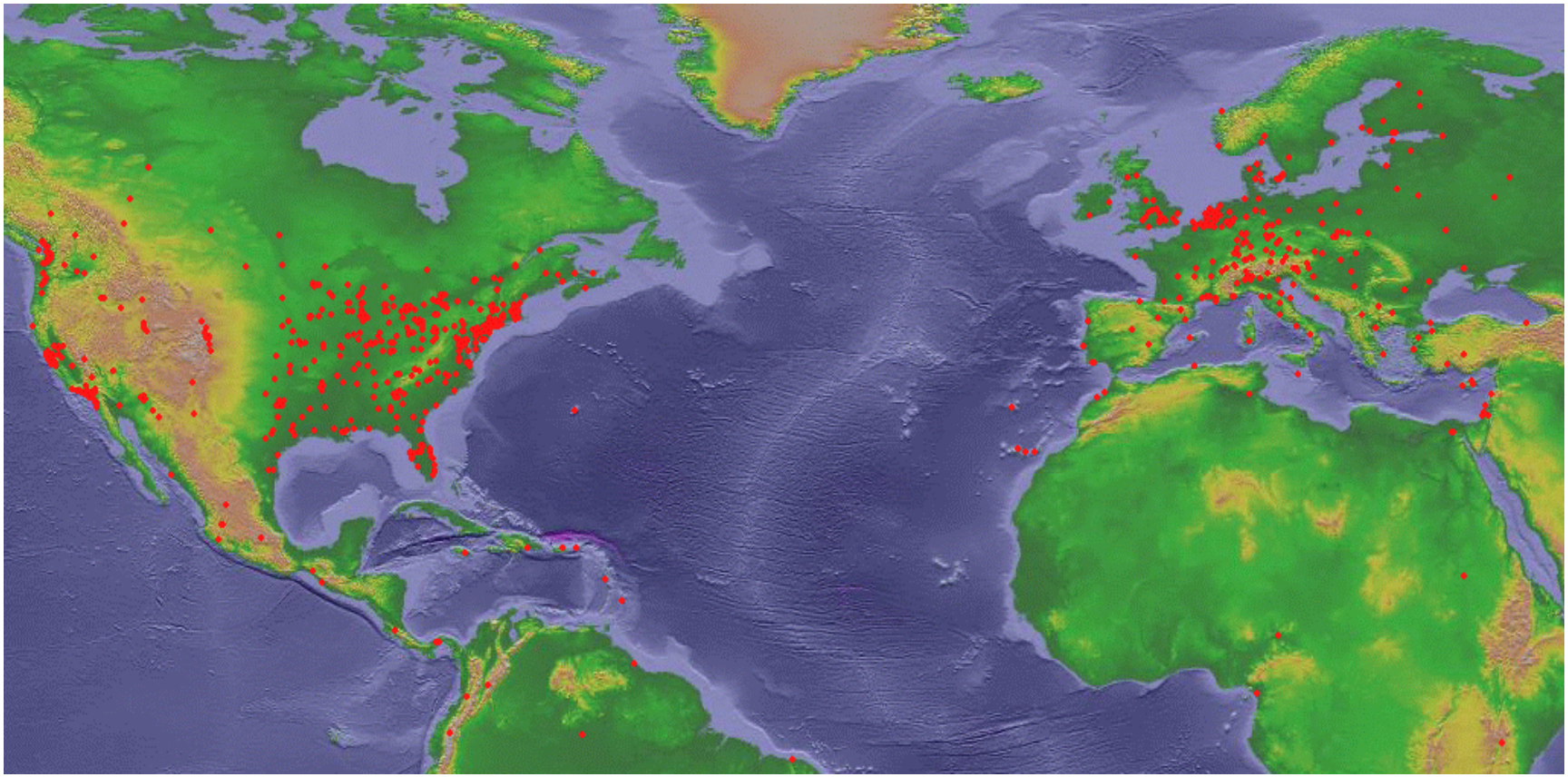
Super Nodes

- *They are established after acceptance test by Skype*
- *They have public IP address*
- *They offer storage, processing & bandwidth*
- *Each Serves 100s Peer Nodes*
- *They route encrypted calls*
- *They execute "NAT" of private IP addresses*
- *They exploit p2p protocol*



SkypeNet Supernode Map
The Power of a 2-level Hierarchy

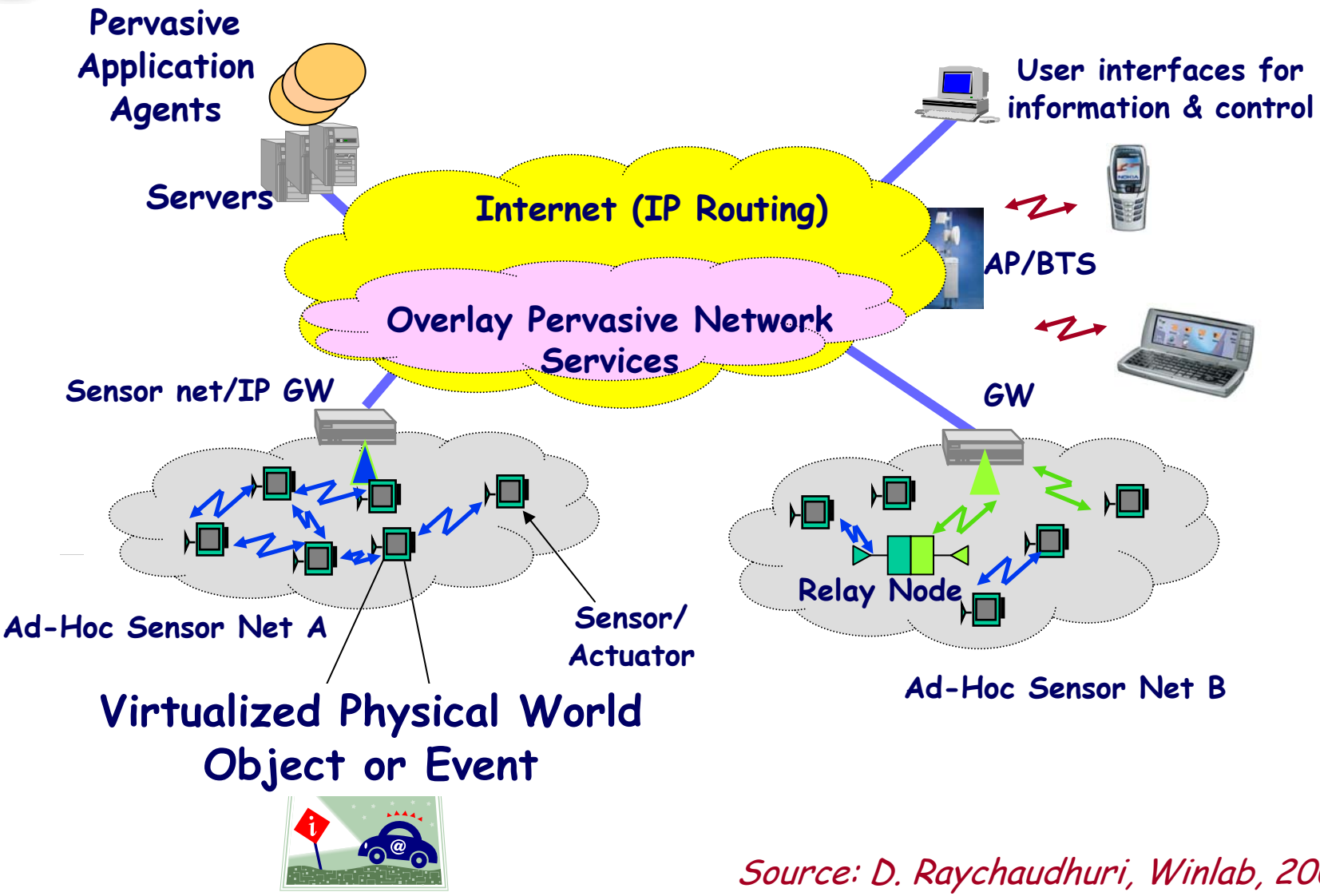
Dipartimento
Elettronica
Informazione



Source: Coobol, December 2005

Wireless Sensor Network Architecture

Dipartimento
Elettronica
Informazione



Source: D. Raychaudhuri, Winlab, 2005

Pervasive Systems Architeture

Pervasive Computing
Context-aware Middleware/Applications

Content-based Overlay Networks
Attribute and Location-aware

IP Wired & Wireless Networks with
Heterogeneous Radio Access & Mobility

Ad-Hoc & Wireless Sensor Networks
with Power-limited Devices

Security

Quality of Service

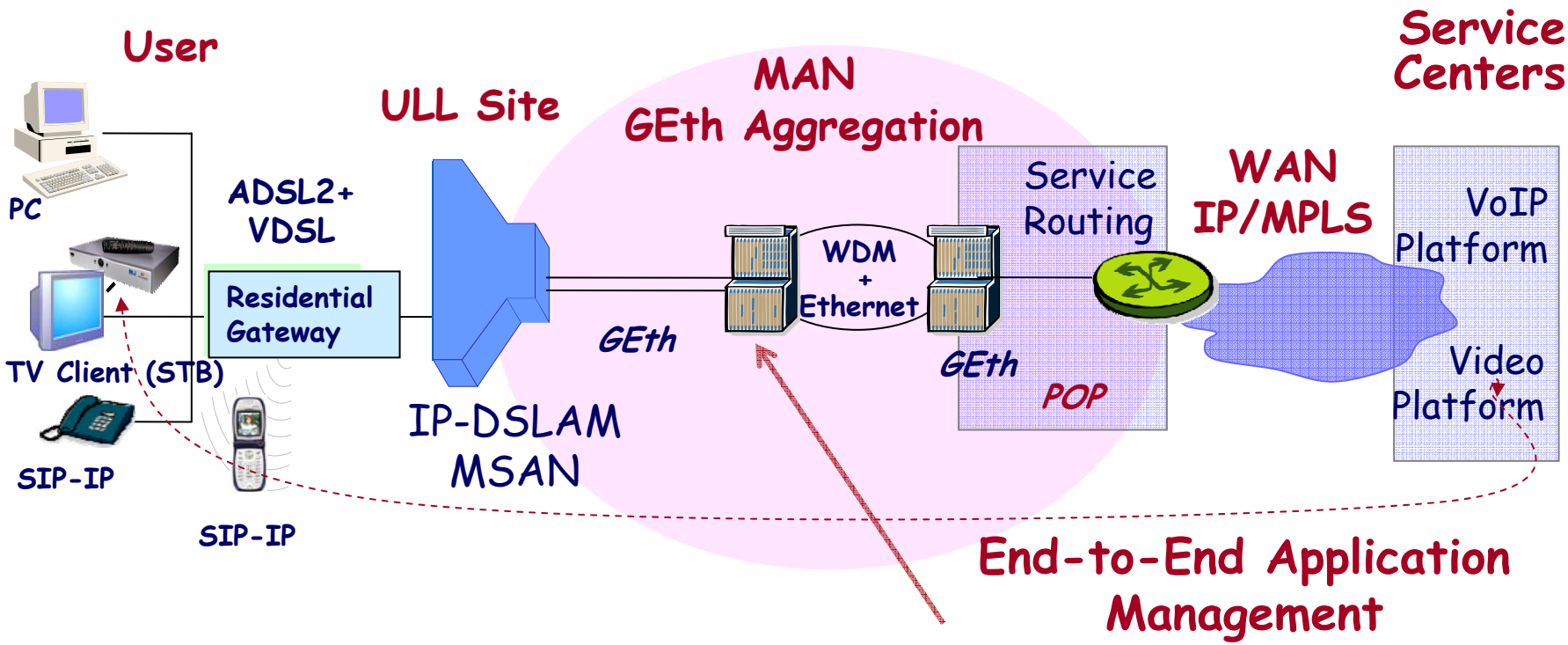
e2e-QoS: Performance, Reliability, Availability, Privacy, Security, Maintainability, ...

ICT Service Convergence

Dipartimento
Elettronica
Informazione

Triple-Play NGN Network Architecture

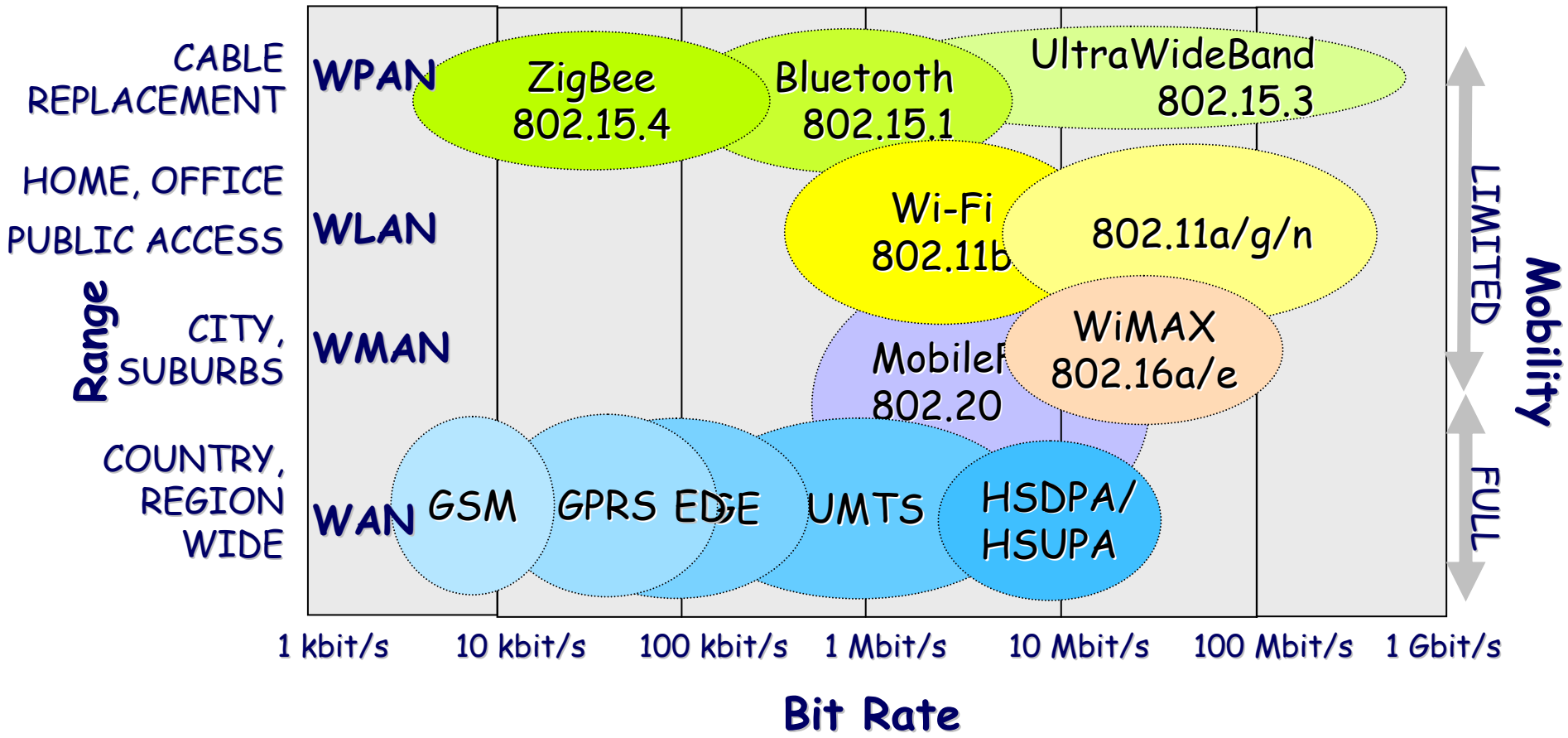
Dipartimento
Elettronica
Informazione



ADSL2+ = 10/20 Mbit/s
VDSL = 50/100 Mbit/s

Provisioning & Profile Enforcement Point for Customer Service Management (Service Ping). Adjunct Point for: Storage, Flow Inspection, Security, Protocol Translation, …

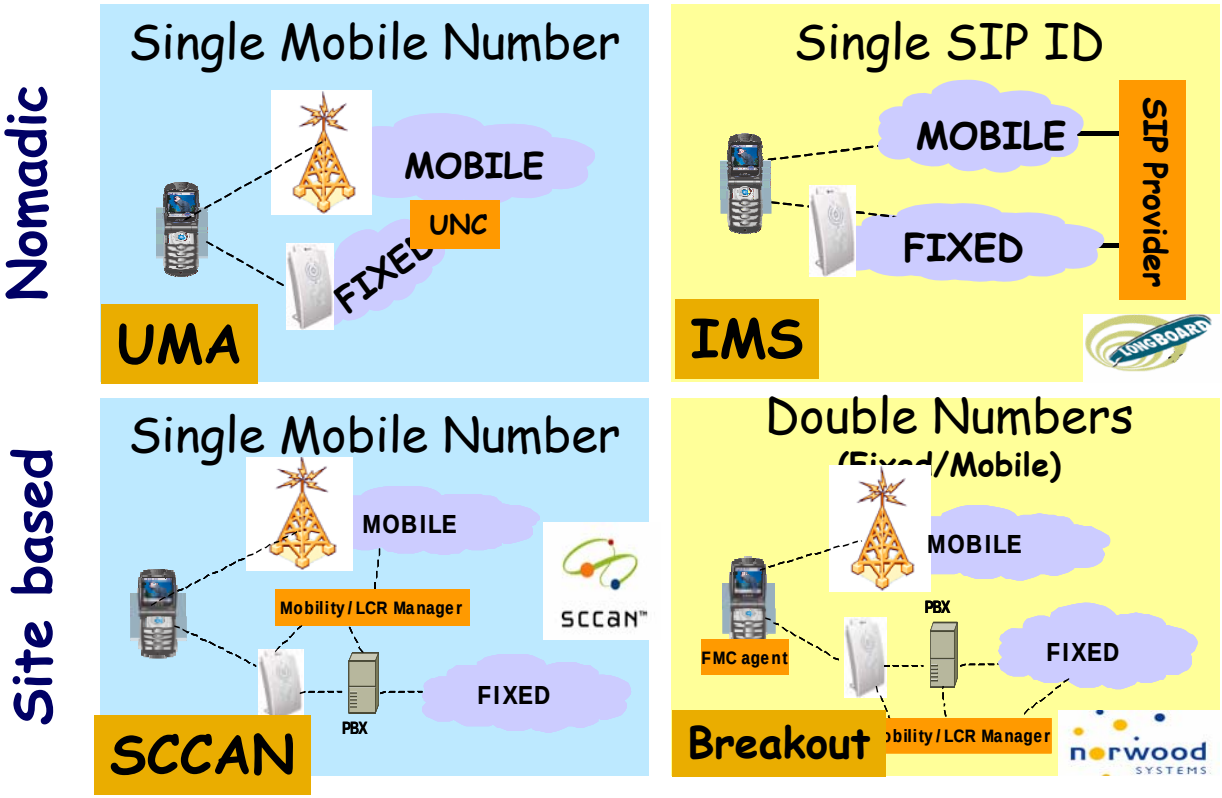
Wireless Communications



Fixed to Mobile Convergence Models

based on Dual Mode Terminals (Wi-Fi-WiMAX/2G-3G)

Dipartimento
Elettronica
Informazione



Longboard, BridgePort, Outsmart,…

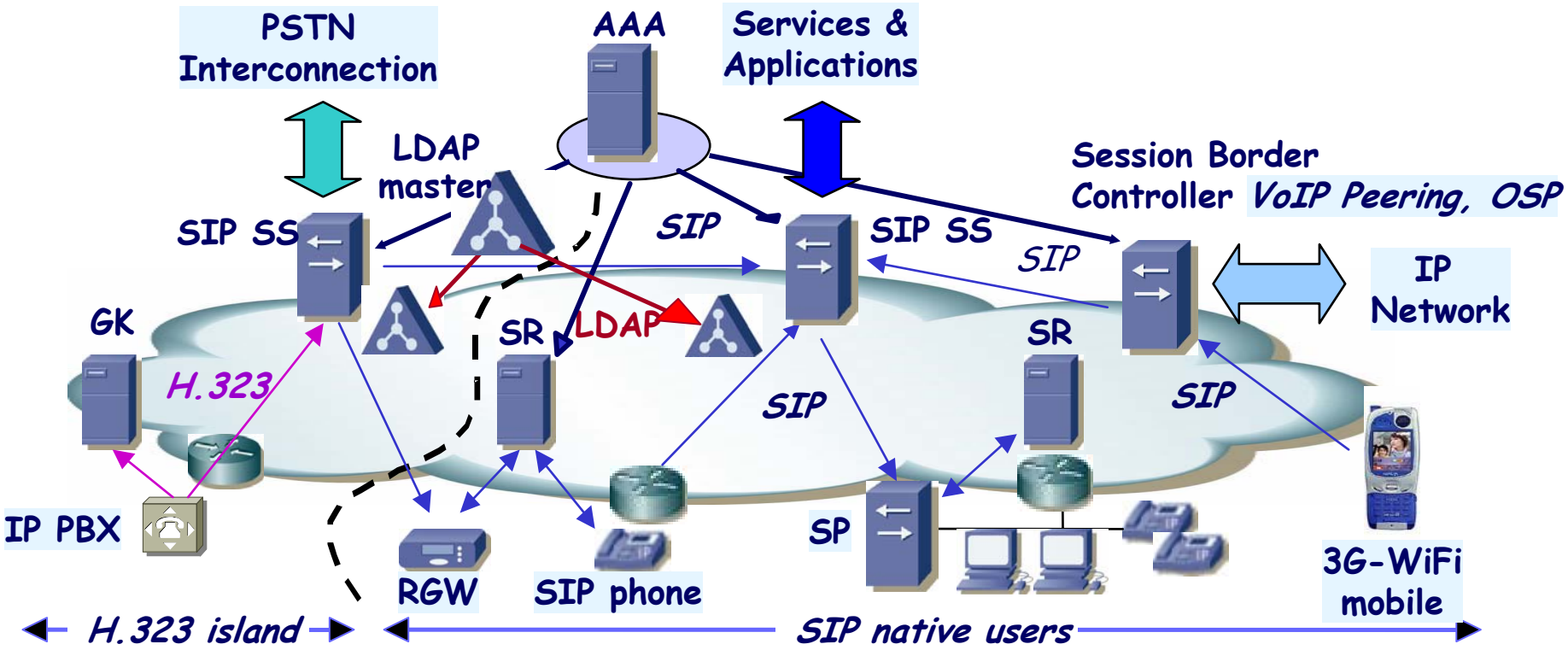
Norwood,...

UMA (Unlicensed Mobile Access)
SCCAN (Seamless Converged Communication Across Networks)

SIP-Based Fixed Mobile Convergence

IMS Approach

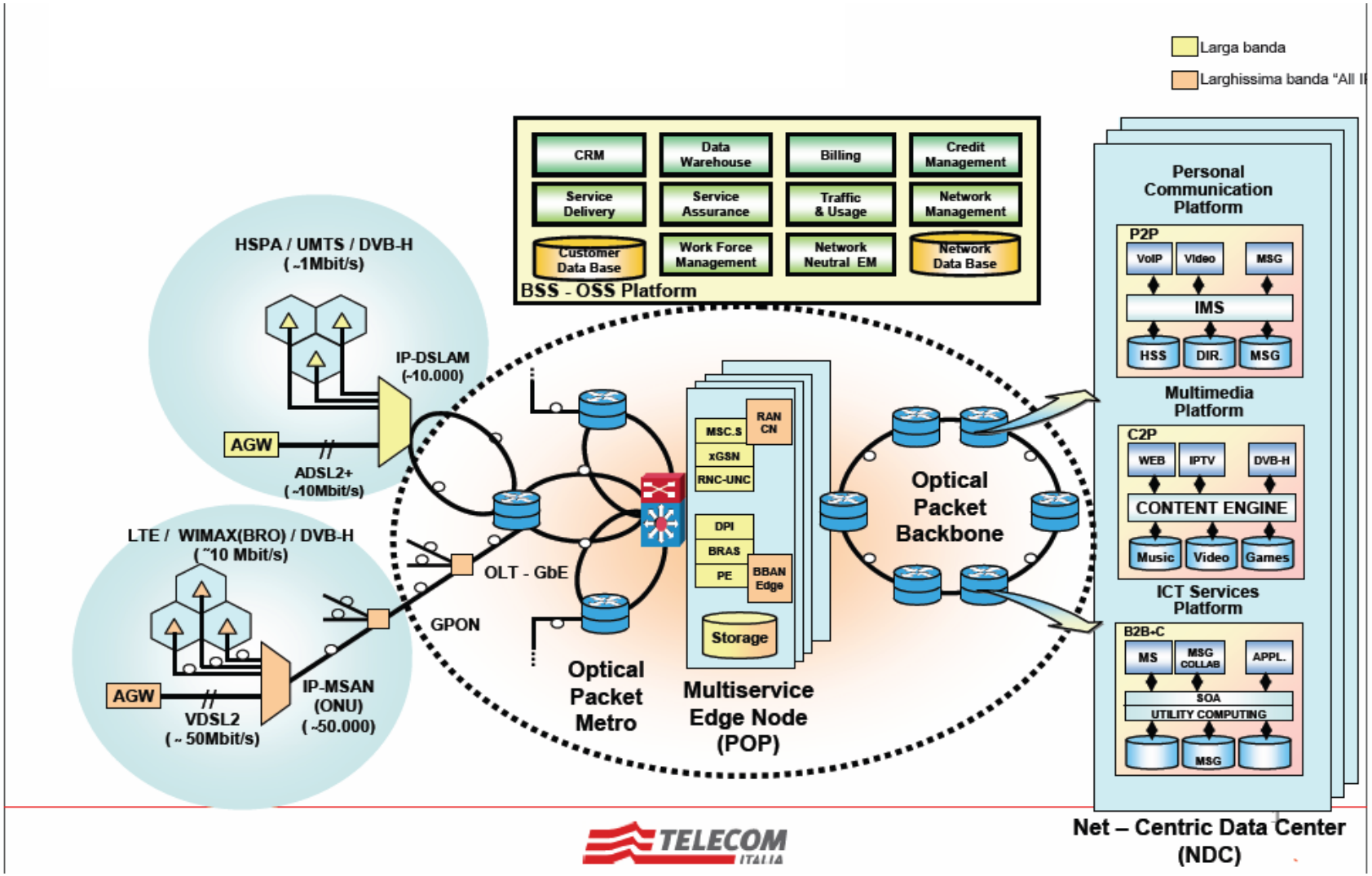
Dipartimento
Elettronica
Informazione



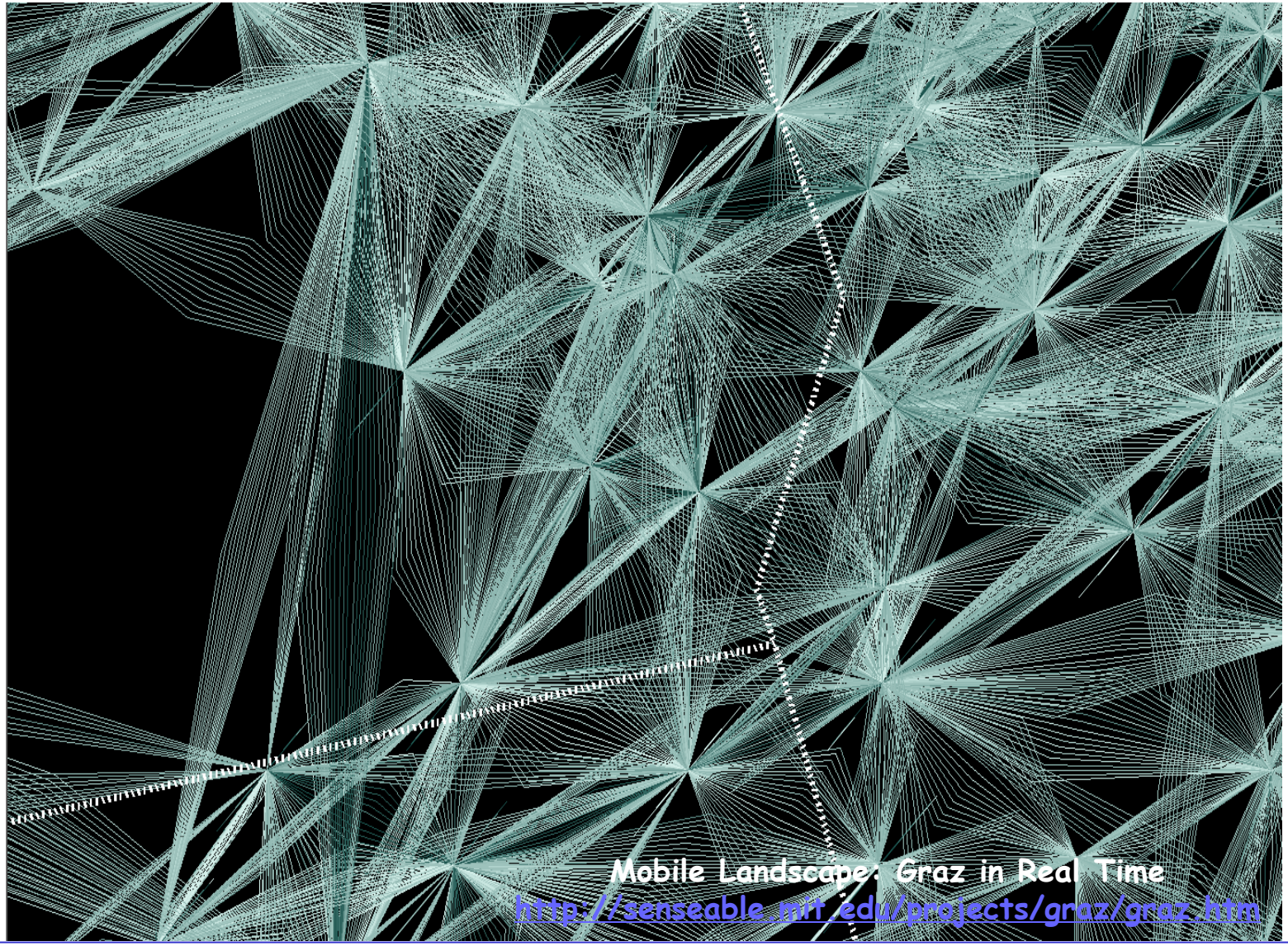
- Distributed session control for voice, video, and messaging services
- Centralized session routing, hierarchical LDAP directories, advanced routing capabilities (i.e. ENUM, IP centrex)
- Distributed registration and access control (AAA)
- IMS logical architecture for convergence with 3G-WiFi and IP networks, fixed and mobile

Next Generation Network

Dipartimento
Elettronica
Informazione

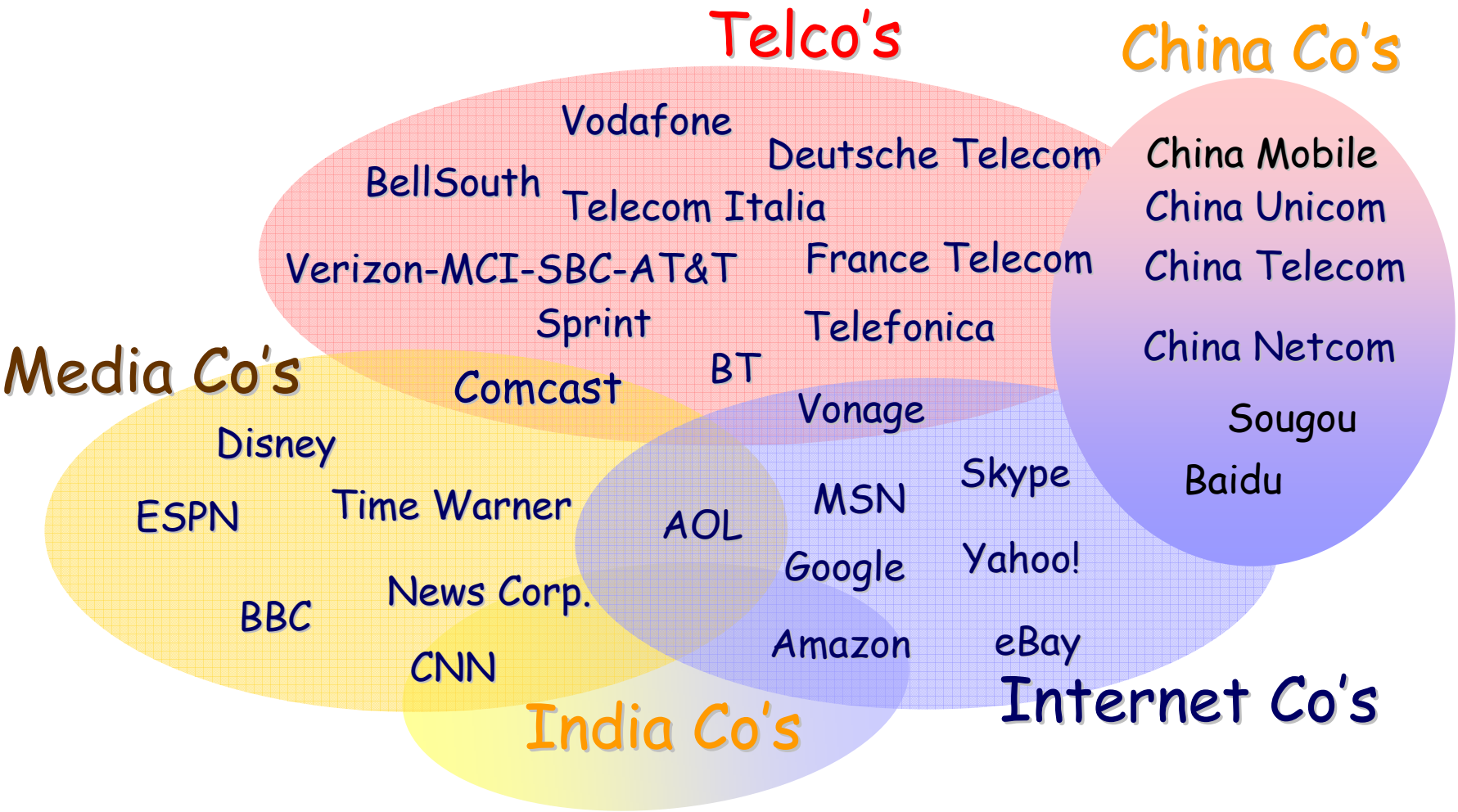


Competition for ICT Services



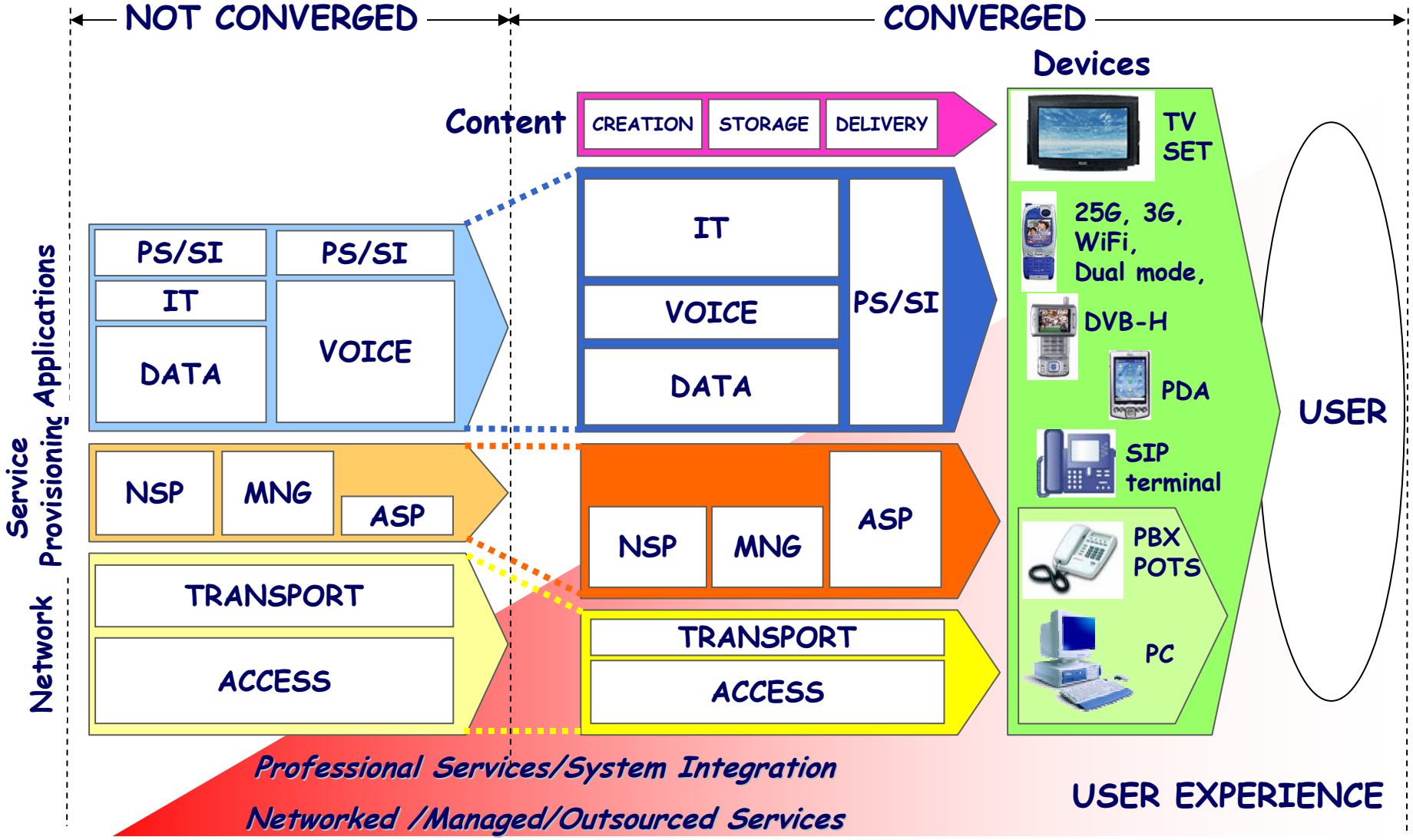
ICMT & World/Chindia Business Convergence

Dipartimento
Elettronica
Informazione



Converged ICT Business Framework

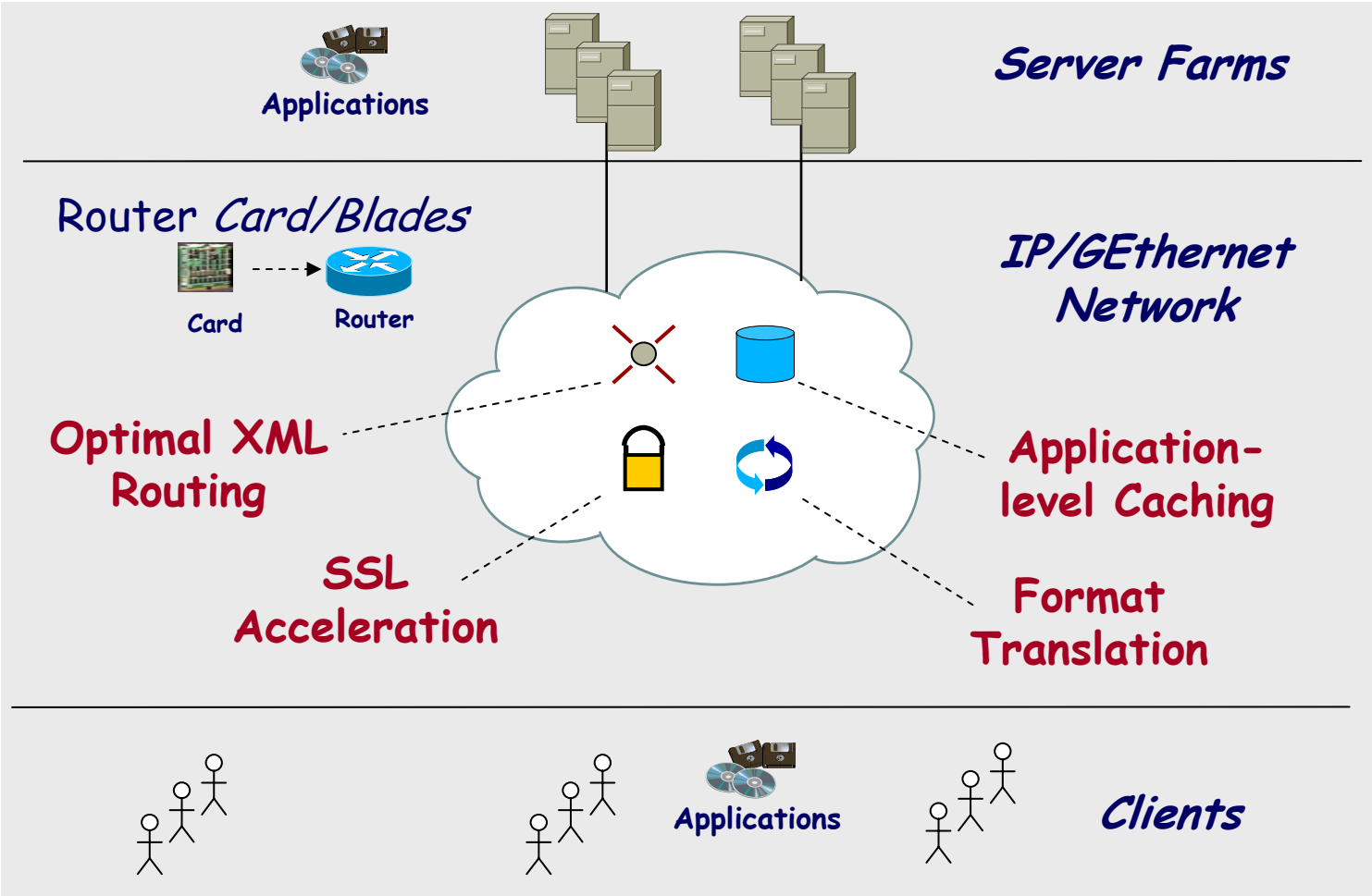
Dipartimento
Elettronica
Informazione



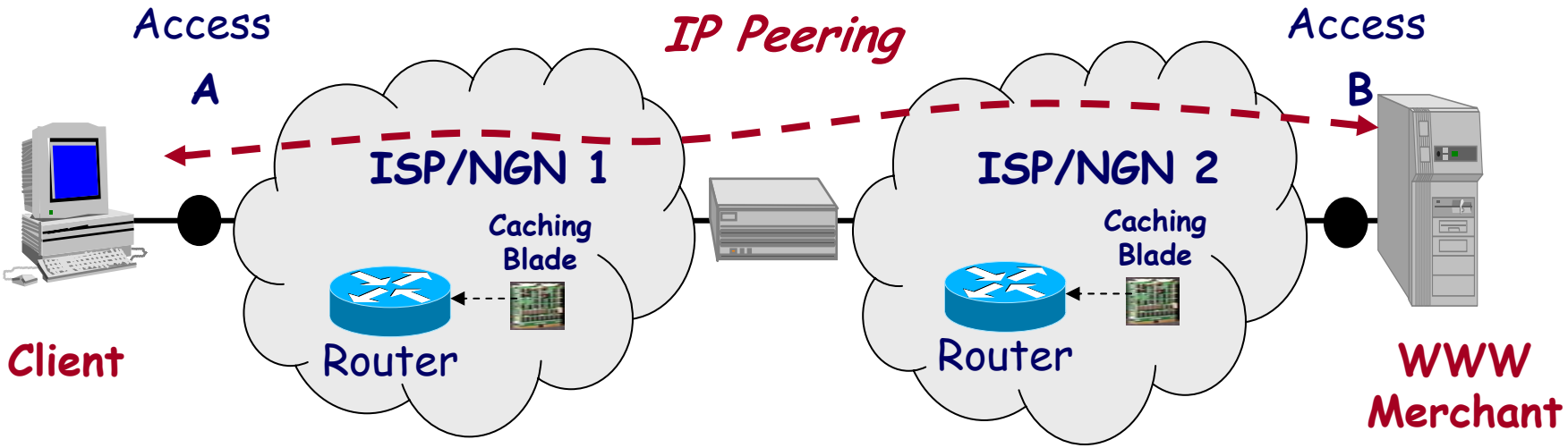
Intelligent Networks Applications

Applications On the Net

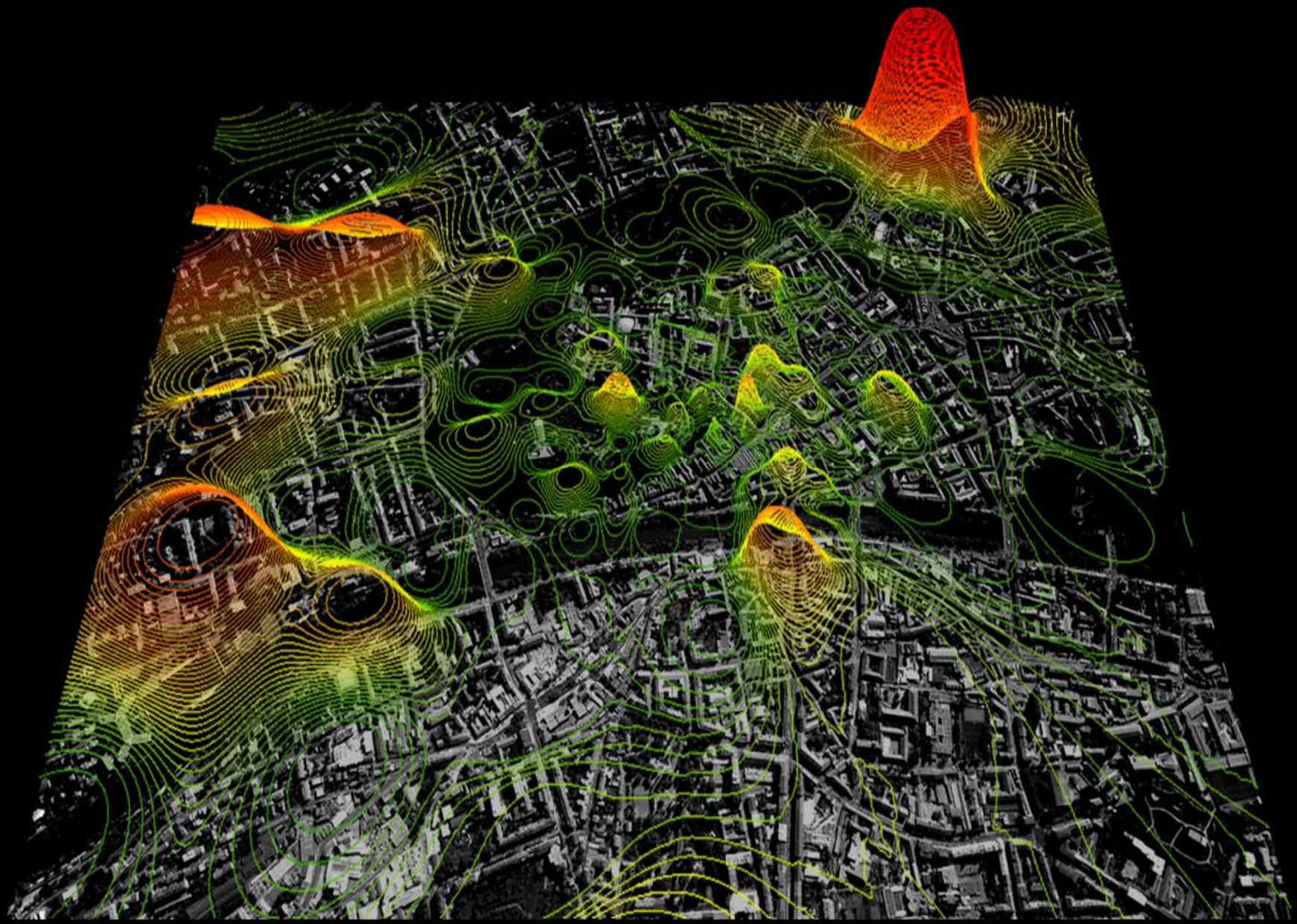
Dipartimento
Elettronica
Informazione



Multiple Carrier Scenario



e2e-QoS: end-to-end Quality of Service



Mobile Landscape: Graz in Real Time

http://senseable.mit.edu/projects/graz/graz.htm