KOREN
KOrea advanced REsearch Network

Future Internet Research Activities and Testbed Experiences in Korea

Future Infrastructure Team

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NIA 한국정보사회진흥원

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Future Internet in Korea

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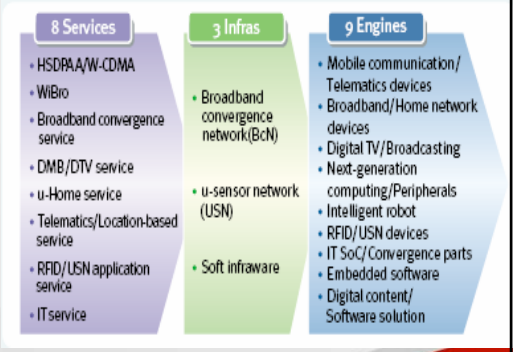
- Ministry of Information and Communications (MIC)
  - IITA (Institute for IT Advancement) : R&D planning and supervision
- BcN developed as the infrastructure for the near future
- National exploratory R&D project on Future Internet is launched in 2007
- "Future Internet" selected as one of the Ten Strategic Areas (from 2008)

MINISTRY OF INFORMATION AND COMMUNICATION REPUBLIC OF KOREA



R&D project

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- Fundamental Technologies for Future Internet (national project by IITA)
- 2007 – 2009 (3 years)
- Approx. 4.4 M$

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Project details

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- R&D Planning (through Future Internet Forum)
  - Identify long-term R&D topics
  - Predict the future technologies
  - Promote collaborations
- Work on selected research topics (universities)
  - Architecture
  - Wireless
  - Services
- Participation to Standard Activities
  - IETF, ITU, IEEE, forum etc.

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FI workshops

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- The first workshop "Internet of the Future"
  - July 20-22, 2006, Seoul, Korea
  - http://mmlab.snu.ac.kr/~kdcho/kcist2006/
- FIW 2007
  - July 9-10, 2007
  - Seoul
- Future Internet Camp
  - Aug. 20-22, 2007
  - Jeju Island

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2007 and later

NIA 한국정보사회진흥원

- Exploratory national projects
- Plan for long-term R&D projects
- Plan, design and test the national Future Internet testbed (KOREN)
- International collaborations
  - Japan
  - China
  - Europe
  - US

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Future Internet Forum

NIA 한국정보사회진흥원

- Established in 2006 to promote R&D collaborations in Future networking
- Building research communities
  - Architecture
  - Wireless
  - Service
  - Testbed
  - Policy
- http://anf.ne.kr/fif/
- Workshops, seminars, publications

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Future Internet Forum

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Architecture Working Group	• Research areas include: ways to fundamentally change Internet architecture through ID/locator separation [GSE = Global, Site, End], etc…
Wireless Working Group	• Research areas include: ad hoc and mesh network deployment to help with diverse apps such as; distributed network weather forecasting and monitoring, sensor network
Service Working Group	• Research areas include: work with industry partners (KT) in MDS [Managed Delivery Service] – links are formed between 3rd Party Provider, User and NGN Provider to deliver content

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Future Internet Forum

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Test bed Working Group	• Research areas include: developing Future Internet test bed (e.g. KOREN] in order to perform end-to-end experiments over diverse technologies and emphasize interoperability, manageability, virtualization and sliceability
Policy Working Group	• Research topics include: setup policy and roadmap for future Internet R&D, Testbed, Future strategy

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KOREN Overview

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- KOREN : KOREA Advanced REsearch Network
  - Non-profit research network
  - Funded by Government [MIC]
  - Established in 1995
  - NIA started its participation in KOREN from 2002
- Support network service and R&D Project
  - Currently, 79 R&D institutions
  - 9 funded R&D Projects in 2007

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Purposes

NIA 한국정보사회진흥원

- To expand the advanced technological research basis of Korea and to support the local IT industry by providing faster, more efficient networks
  - Support for international cooperation research projects
  - A testbed for the next generation network technology, applications and services
  - Support for Government's pioneering pilot projects with advanced technology (e.g. BcN)

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Network Connection

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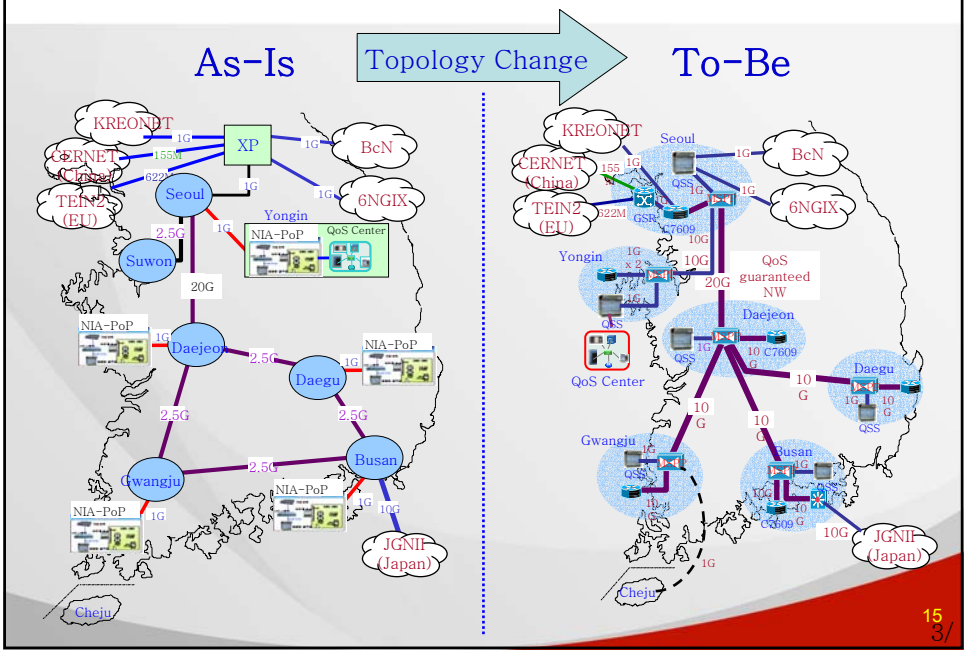

Network Facilities

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- 8 Giga PoPs
  - PoPs : Seoul (2), Daejeon, Daegu, Pusan (2), Kwangju, Suwon
- 5 Open Test-beds
  - Seoul (NIA), Daejeon (ICU), Daegu, Pusan, Kwangju
- 2.5G ~ 40Gbps backbone
  - Seoul – Daejeon: 20G
  - Daegu – Daejeon – Kwangju – Pusan: 10G
  - Seoul – Suwon: 10G

Network Enhancement

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Application	IP	DWDM	Optical Fiber

Application			
IP (R&E)	IP (Test)	IP (Logical)	Etc.
		MSPP/MSTP	
Optical Switch			
DWDM			
Optical Fiber			

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Network Function

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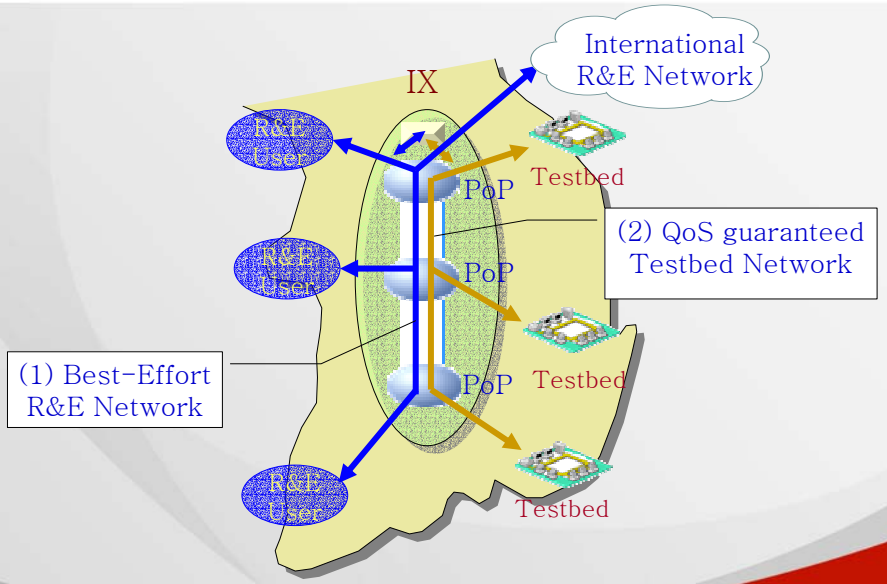

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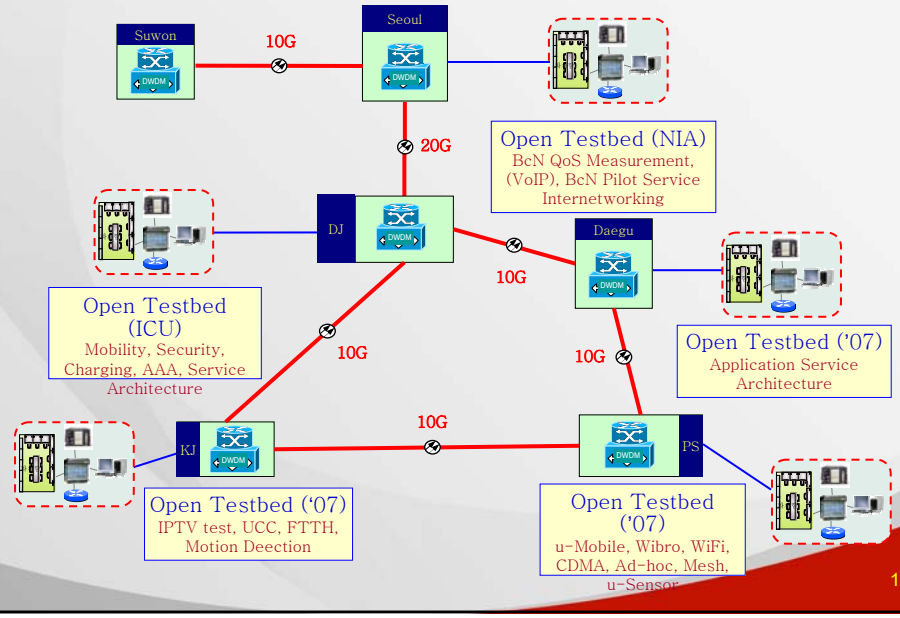
Open Lab Testbed



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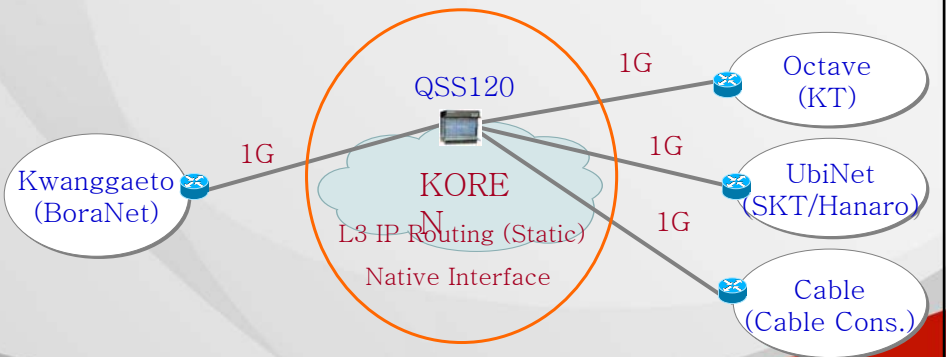
BcN Pilot Service Interworking

- Interworking network for BcN Operators
  - Service Interworking Test
  - Terminal Interoperability Test
  - QoS Measurement Center



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Sensor Network Research

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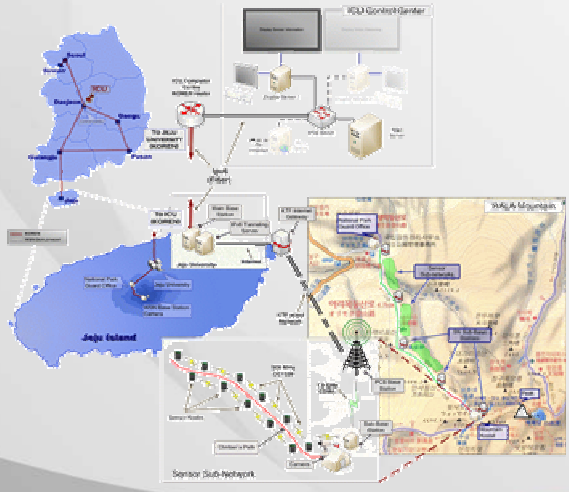
❑ KOREN-based application test—a nationwide USN (Ubiquitous Sensor Network) Architecture over IPv6



- Low-power consumption sensor development
- Precise weather forecasting using sensor nodes
- Monitoring software development for sensor networks
- Sensor networking architecture
- Transmitting method and management of collected data

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Mesh-based Access Network

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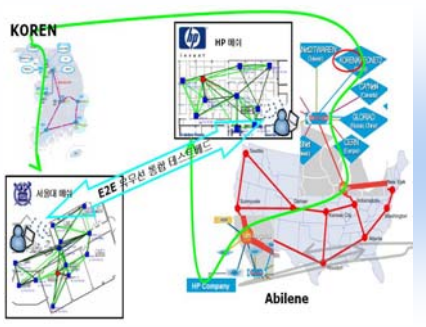
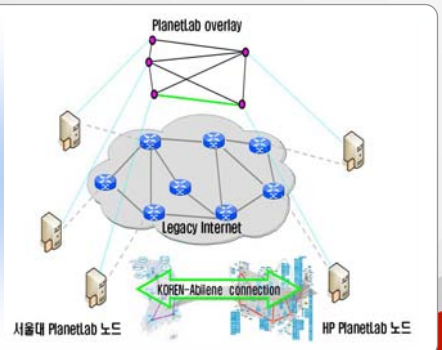
Testbed

- Consortium: SNU, HP-USA (Mobile Media System Lab)
- Testbed Configuration
  . SNU Mesh – KOREN – Abilene - HP Mesh
  . SNU PlanetLab node – KOREN – Abilene - HP PlanetLab node

Project

- Performance evaluation
  . TCP/UDP Data Throughput, Delay, Multi-hop analysis
- PlanetLab Over KOREN
  . PlanetLab Testing over KOREN





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IPTV Overlay Multicast

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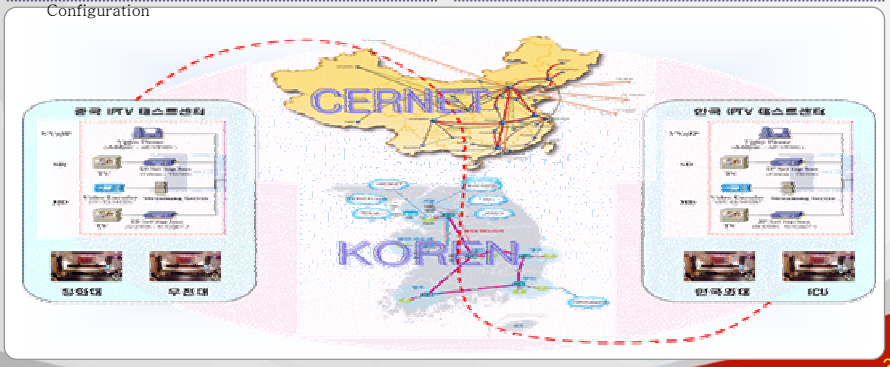
Testbed

- Consortium: HUFS, ICU, RivertreeNet, Tsinghua Univ., BUPT
- Testbed Configuration
  - . KOREN Daejeon-Yongin RACF Overlay Multicast Testbed configuration
  - . KOREN-CERNET IPTV Service Interworking Testbed Configuration

Project

- End-to-End Resource Control, QoS qualified Multicasting Technology
  - . Web-based IPTV QoS scenario, Web-based EPG (Electric Program Guideline) Development
  - . NGN RACF based Overlay Multicast Technology
- IPTV Server/Client Test Model Research



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Nationwide IP-USN Networking

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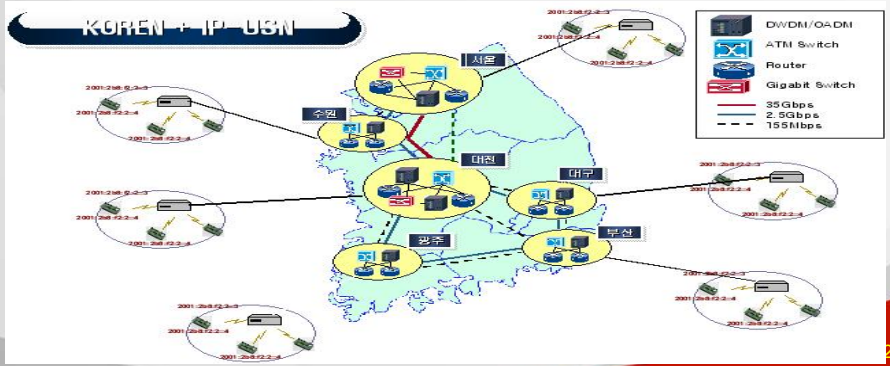
Testbed

- Consortium: AJU, PicosNet, iBit, IETF 6LowPAN WG
- Testbed Configuration
  - . IP-USN Interworking Testbed in 6 KOREN PoPs
  - . Test for Different IP-USN Routers

Project

- Interworking and routing protocol test in USN networks
- Efficient Interworking protocol testing between KOREN and IP-USN
  - . IP-USN Bootstrap function
- IP-USN Networking technology Stands with IETF 6LowPan WG



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Wireless Multimedia Sensor Network

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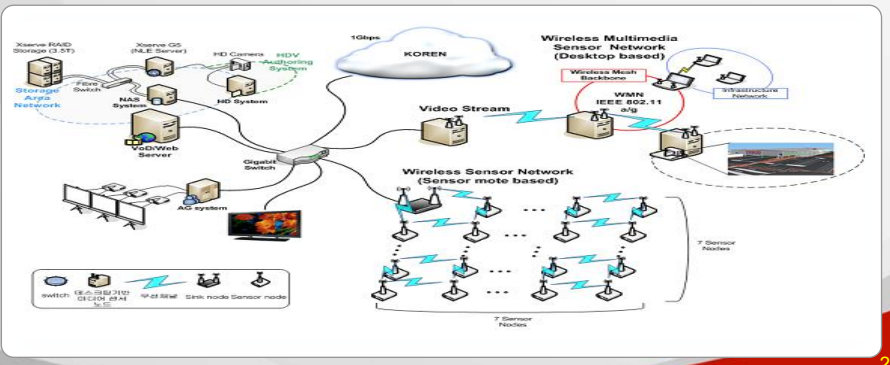
Testbed

- Consortium: GIST, SKU, OSU, UIUC
- Testbed Configuration
  - . WMN with KOREN interconnected Server Routers IEEE802.15.4/Zigbee-based Sensor node Testbed (7X7 Grid Topology)
  - . GIST-KOREN-SKU

Project

- WMN based multi-hop, Multimedia transmission technology
  - . HD multimedia data transmission technology on Wireless and wired convergence network
- Scheduling technology for minimum interference in WSN network



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FN Testbed Activities

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- Define the need for Future Network Testbed
  - Purpose of the Future Network Testbed
  - Various Requirements on the FN testbed
- Agenda for research using FN Testbed
  - R&D Topics on the FN testbed
  - The anticipated range of experiments
- International Cooperation
  - Various R&D projects with foreign institutions
  - OMNIA …
- Conceptual design
  - Set-up a reference model for FN Testbed
  - Refer to world FN testbed architectures
  - Realizing of ideas (Substrates, Network control, etc…)

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OMNIA – Architecture

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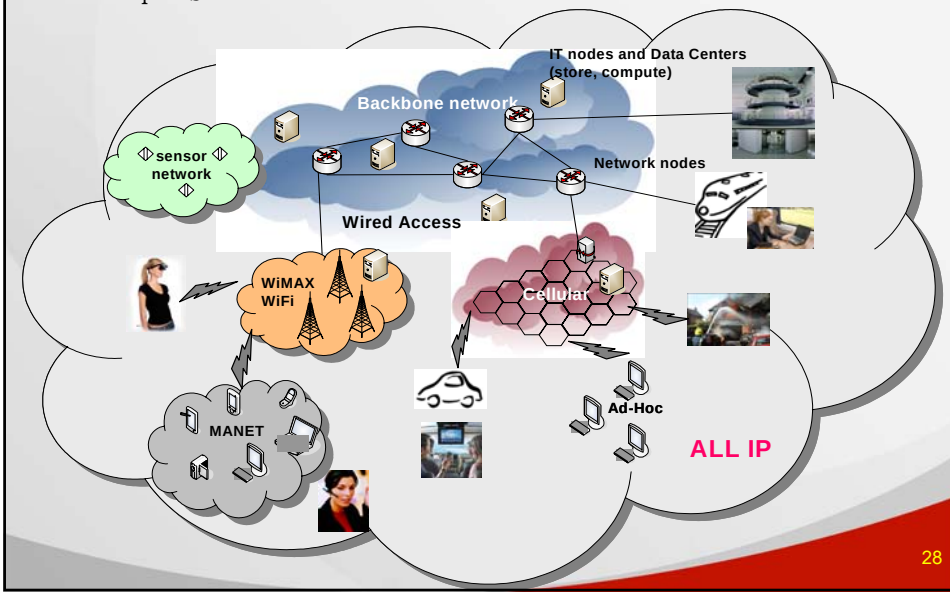
Omnipresent Mobile Next Generation Internet Architecture



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OMNIA - Map

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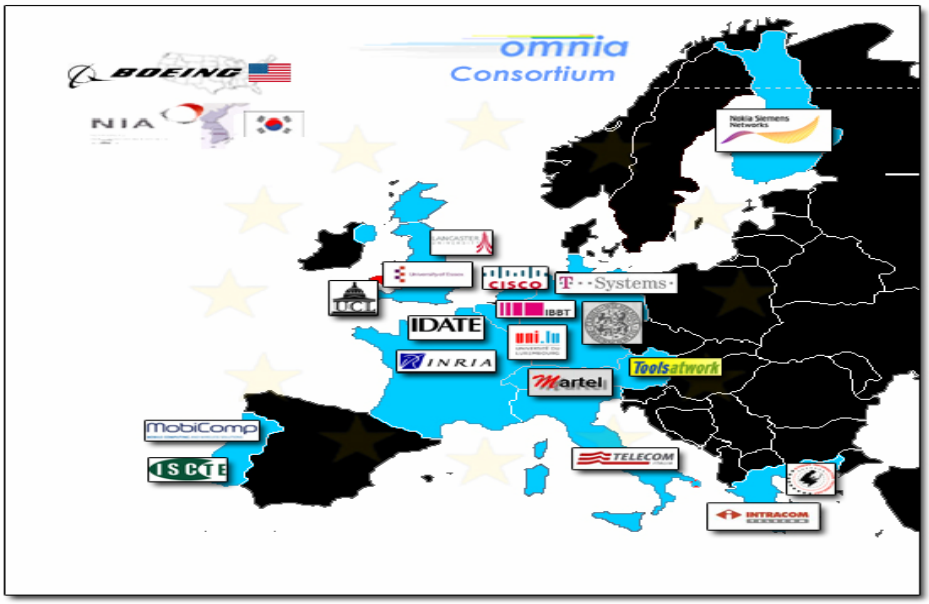


WP0
Project Management

Cisco
Martel

WP1 OMNIA Architecture
Architecture definition - user behavior analysis, usage patterns, static & mobile users, scalability, resilience, QoS, E2E, data protection
bidirectional context management, security
Architectural refinement - constant refinement, roadmap definition
Long term clean slate architecture design - US GENI, holistic approach, challenges like new functionality boundaries, electriity consumption
IBBT, Essex, Cisco, Motorola, AIT, UCL, NIA, T-Systems, TI

WP4
Scalable Mobility Support Systems xxx

Scalable solution for very high-speed and highly dynamic network
Privacy policies realisation
Identity and location management
- User based
- Device base
- Both

AAA realisation for mobile environment
- IETF solutions
- New solutions ?
- Trust model for ad-hoc networks
  - Other people resources
  - Overlaying different trust models onto ad-hoc networks

Security
- Legal issues in ad-hoc connectivity provisioning
- Lawful interception

Encryption
Attack avoidance mechanism

UCL
Cisco, T@W?
Luxembourg

WP5
Seamless End-to-End Service Delivery

Seamless mobility between different access technology and services
- Transcoding
- Support for high-speed mobility

Handover issues
Integrated NW & IT Resource Mobility & Mgmt
FMC
E2E QoS
MC capability/compatibility issues between different access technologies
Context aware Application API
L2 L3 interaction and interfaces

Essex
T-Systems
Motorola
IBBT
AIT
UCL

WP6
IP Edge Mobility

Mobile Entity (IP)
- Host, User, NW

Resource Mgmt. IFs
MONAMI6
- Multiple IF Mgmt
- Policy & Preferences

NEMO
MANET
MANEMO
Alternative Solutions

Lancaster
Cisco
INRIA
BOEING

WP7
Proof of Concept

Demonstration key points
- Mobile content sources
  - E.g. Video
- Multicast and broad cast
  - To and/or from mobile source
- Nested mobility ?
- Seamless mobility ?
- Vertical handovers ?
- Network adaptability
  - Trans-coding & Trans-rating
  - Maintaining QoS

Demo Scenario
- Mobile interactive application
  - Mobile gamming
- Mobile content provisioning
  - Tour-de-France
- Emergencies and flash crowd

Cumbria
Use Essex & Gent as tech labs
Use U2010 demo scenarios

Mobicomp
3GDoctors
T@W
Yahoo

All IP, 3G, 4G, WiMAX, WiFi, UWB, FMC, UC, vehicle, train, airplane, Ad Hoc NWs, Mobile User

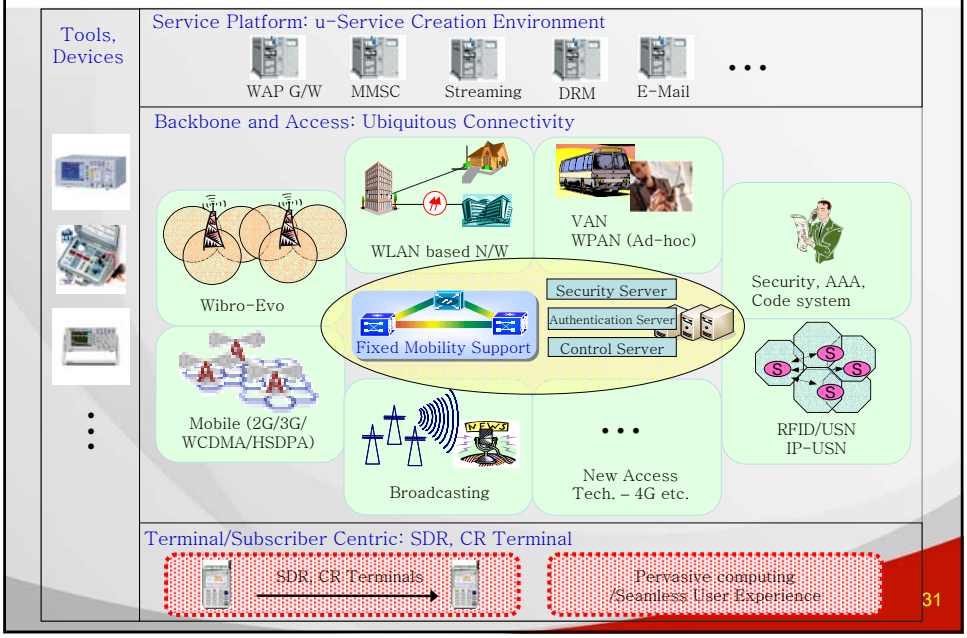
WP2 Policy & Regulation
Cisco, Motorola, UCL, Essex, Yahoo

WP3 Business Models & Service Innovation
Business models, Use case studies, define applications to be demonstrated in WP7, New services, Social impact
T-Systems, TI, ISCTE, Motorola, iDate, Yahoo, T@W, NIA

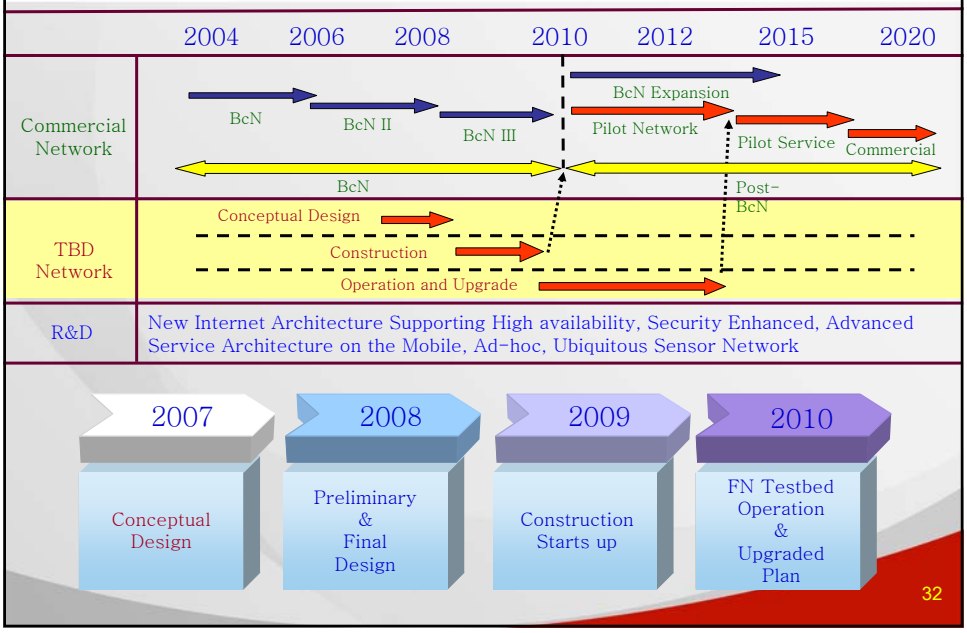
WP8
Dissemination Training

Luxembourg
Martel
Cisco

Future Network Testbed – Short-Term



FN Testbed Roadmap



Thank You !!

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WP1 OMNIA Architecture

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Tasks

- Architecture definition – user behavior analysis, usage patterns, static & mobile users, scalability, resilience, QoS, E2E, data protection bidirectional context management, security
- Architectural refinement – constant refinement, roadmap definition
- Long term clean slate architecture design – US GENI, holistic approach, challenges like new functionality boundaries, electricity consumption

Participants

IBBT, Essex, Cisco, Motorola, AIT, UCL, T-Systems, TI, NIA

WP3 Business Models & Service Innovation

Tasks

Business models, Use case studies, define applications to be demonstrated in WP7, New services, Social impact

-> u-Healthcare Service

Participants

T-Systems, TI, ISCTE, Motorola, iDate, Yahoo, T@W, NIA