DOCOMO’s Actions for New Growth

Ryuji Yamada
NTT DOCOMO, Inc.
June 6, 2011.
# Table of Contents

1. **DOCOMO’s Response to the Great East Japan Earthquake**

2. **Recent Trends in the Mobile Market**

3. **DOCOMO’s Actions for New Growth**
   1. Evolution of Smartphones
   2. Expansion of “Xi” LTE Service and Network Evolution
   3. Cultivation of New Business Fields

4. New Corporate Vision “HEART”
1. DOCOMO’s Response to the Great East Japan Earthquake
Great East Japan Earthquake: 14:46 Mar. 11, 2011

Sendai

Fukushima Nuclear Power Plant (20km-30km)

Tsunami Affected Area

Earthquake Epicenter

Sendai

Kyoto

Osaka

Tokyo

690Km

©2011 Google – Images ©2011 TerraMatrics
Damage of Tsunami: Minami-Sanriku (1)
Damage of Tsunami: Minami-Sanriku (2)
Base Station Equipment (1)

Washed away by Tsunami

Ishinomaki-Midori, Miyagi
Base Station Equipment (2)

Opposite side of the base station

Ishinomaki-Midori, Miyagi
Ishinomaki-Higasi, Miyagi
Restoration Status of Service Areas

As of Mar. 12, 2011

Service disrupted at 4,900 base stations

As of Apr. 30, 2011

Service available

Service disrupted

Restored to nearly pre-disaster level
• Restored almost all base station that required restoration as of March 31, except for a limited number of base stations located within 30Km radius of Fukushima Daiichi Nuclear Power Plant

Areas in the 3 prefectures of Tohoku except for those within 30km radius of Fukushima Power Plant
(No. of base stations requiring restoration)

- 307
  - 248 (Planned to be restored by April 30, 2011)
  - 59 (Planned to be restored by May 31, 2011)

Areas within 30km radius of Fukushima Power Plant

- 68
  - 68 base stations restoration completed
  - 17 base stations restoration completed

Restoration methods: breakdown

- Optical fiber/stopgap optical fiber:
  - 154
  - 23

- Large zone from mountain top, etc.:
  - 67
  - 28

- Microwave transmission:
  - 44

- Satellite circuit:
  - 36

Mar. 28
End of April
End of May

- 301 base stations restoration completed
- 51 base stations restoration completed
- 51 base stations restoration completed
- 12 base stations restoration completed
- 17 base stations restoration completed
- 17 base stations restoration completed
Restoration using large-zone scheme
Restoration using satellite circuits

Ishinomaki, Miyagi
Installed high-performance antenna

Iwaki, Fukushima: 25 km away from Fukushima Power Plant
Replaced transmission line of base station

Tomioka, Fukushima
• Restored coverage in areas within 20km radius from Fukushima Daiichi Nuclear Plant and along Route 6 (the access route to the power plant)
“Restoration Area Maps”

Easy-to-read maps indicating in different colors the areas where service is available or disrupted, and the restoration schedule of disrupted areas

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar. 21, 2011</td>
<td>Areas where service is available, Areas restored by mobile base station vehicle, Areas to be restored by mobile base station vehicle, Areas where service is disrupted (to be restored by Mid-Apr), Areas where service is disrupted (to be restored by Mid-Late Apr), Areas where service is disrupted (to be restored after May)</td>
</tr>
<tr>
<td>Apr. 4, 2011</td>
<td>Free mobile phone service, Free satellite phone service, Free battery recharging service</td>
</tr>
</tbody>
</table>
New Disaster Preparedness Measures

(1) Securing communication in key areas
Secure means of communication for densely populated areas/administrative organizations

(2) Swift response to disaster-stricken areas
Secure means of communication for densely populated areas/administrative organizations

(3) Further improvement of customer convenience in disasters
Secure means of communication for densely populated areas/administrative organizations

1. Deploy large-zone base stations across Japan (approx. 100 locations)
2. Promote use of uninterruptible power supply systems and ensure 24-hour autonomous power supply in base stations (Approx. 1,900 stations)
3. Swift provision of satellite mobile phones (3,000 units)
4. Quick construction of service areas using satellite system
5. Flexible area construction using microwave entrance circuits (100 sections)
6. Development of disaster voice message service
7. Enrichment of “Restoration Area Maps”
8. Support of voice guidance in “Disaster Message Board” service for improved ease of use
9. Further utilization of “Area Mail”
10. Further utilization of ICT through convergence with SNS, etc.
Deployment of Large-Zone Base Stations

• Newly construct base stations using large-zone scheme separately from ordinary base stations to secure communications in densely populated areas in the event of a wide-area disaster or power outage (approx. 100 locations across Japan)
Uninterruptible Power Supply/24-Hour Battery Supply

- Promote use of uninterruptible power supply systems and ensure 24-hour autonomous battery supply in base stations to secure communication in prefectural/municipal government offices and other important institutions (Approx. 1,900 stations)

**<Base stations in DOCOMO buildings, etc.>**

**Engine-driven uninterruptible power supply** (Approx. 800 stations)

- Wireless transmission
- Prefectural/municipal government offices, etc.

**<Tower base stations>**

**24-hour battery supply** (Approx. 1,100 stations)

- Wireless transmission
- Prefectural/municipal government offices, etc.
Development of Disaster Voice Message Service

- Develop a service that efficiently carries voice message to the destination after converting them into voice files, because voice calls are difficult to get through in the event of a disaster due to congestion caused by massive outbound calls.

Planned for launch in FY2011
Utilization of ICT through Convergence with SNS

- Support retrieval of information in the event of a disaster through the convergence of mobile with SNS, etc.
## New Disaster Preparedness Measures: Financial Impact

<table>
<thead>
<tr>
<th>Overview</th>
<th>Estimated impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td></td>
</tr>
<tr>
<td>CAPEX</td>
<td>Profit/Loss</td>
</tr>
<tr>
<td>Securing communication in key areas</td>
<td></td>
</tr>
<tr>
<td>(1) Deployment of large-zone base stations</td>
<td>¥3.0 billion</td>
</tr>
<tr>
<td>(2) Uninterruptible power supply, 24-hour battery supply</td>
<td>¥14.0 billion</td>
</tr>
<tr>
<td>Swift response to disaster-stricken areas</td>
<td></td>
</tr>
<tr>
<td>(3) Increase of satellite mobile phones</td>
<td>¥1.0 billion</td>
</tr>
<tr>
<td>(4) Increase of satellite entrance circuits</td>
<td>¥1.0 billion</td>
</tr>
<tr>
<td>(5) Deployment of emergency microwave entrance facilities</td>
<td>¥1.0 billion</td>
</tr>
<tr>
<td>Improved convenience</td>
<td></td>
</tr>
<tr>
<td>(6) Provision of disaster voice message service</td>
<td></td>
</tr>
<tr>
<td>(7) Improvement of “Restoration Area Maps”</td>
<td></td>
</tr>
<tr>
<td>(8) Support of voice guidance in “Disaster Message Board” service</td>
<td>¥0.5 billion</td>
</tr>
<tr>
<td>(9) Further utilization of “Area Mail”</td>
<td></td>
</tr>
<tr>
<td>(10) Further utilization of ICT through convergence with SNS, etc.</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>¥20.5 billion</td>
</tr>
</tbody>
</table>
DOCOMO’s Actions for New Growth
2. Recent Trends in the Mobile Market
DOCOMO’s Position in Japan’s Mobile Market

• DOCOMO controls the largest market share of subscribers in Japan

■ Total mobile phone subscriptions (As of April 2011)

- **KDDI**
  - 33.00 million (27%)
- **SoftBank**
  - 26.00 million (21%)
- **EMOBILE**
  - 3.00 million (3%)

Source: Telecommunications Carriers Association (May 2011)
Japan Leads the World in Mobile Broadband

- Japan leads the world in the adoption of third-generation (3G) mobile communications service
- The widespread use of mobile broadband contributed to the development of applications

3G penetration in Japan, North America, Western Europe and Southeast Asia* (2003-2013)

(Source): Wireless Intelligence

* Southeast Asia: Malaysia, Thailand, Vietnam and the Philippines
Japan Leads the World in % of Data to Total Revenues

- Japan leads the world in the % of data communications to total revenues as a result of early introduction of i-mode and other advanced services

% of data communications in ARPU

*ARPU= Average monthly revenue per user

- Japan (Launched Oct. 2000)
- USA (Verizon Wireless) (Launched Feb. 1999)
- Europe (Vodafone)
- Korea (KT)

<table>
<thead>
<tr>
<th>Year</th>
<th>Japan</th>
<th>USA</th>
<th>Europe</th>
<th>Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>30%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>40%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>50.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DOCOMO’s Data ARPU Growth

- Growth of data ARPU has accelerated, with data ARPU overtaking voice ARPU in FY2010

<table>
<thead>
<tr>
<th></th>
<th>FY2009</th>
<th>FY2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Voice ARPU</td>
<td>¥2,540</td>
<td>¥2,530</td>
</tr>
<tr>
<td>(2) Data ARPU</td>
<td>¥2,530</td>
<td></td>
</tr>
</tbody>
</table>

Aggregate ARPU ((1)+(2))

Reversal of voice and data ARPU
3. DOCOMO’s Actions for New Growth
3-1. Promotion of Smartphones
Rapid Expansion of Smartphone Market

- “Android OS” expanding remarkably in smartphone market

Global smartphone market share breakdown by OS

- **Android** 48.8%
- **iOS** 17.2%
- **RIM** 11.1%
- **Microsoft** 19.5%
- **Symbian** 36%

Source: Gartner (April 2011)

Distinctive properties of “Android OS”

- Open OS offering high scalability of functions
- Allows delivery of various services to smartphones through functional enhancements

<Examples>
- “Osaifu-Keitai” e-wallet
- One-segment broadcasting
- Infrared data exchange

DOCOMO selected Android for its main OS

Remarks:

- Remarkable increase from 0.3 billion units to 1.1 billion units
- 2010 vs. 2015 (forecast)
Smartphone Lineup

• Prepared the finest collection of smartphones that offer “choice”, “practical benefits” and “enjoyment” with our 2011 Summer models

2011 Summer Models: 9 smartphone models

- GALAXY S II
- MEDIASWP
- Xperia acro
- AQUOS Phone
- F-12C
- P-07C
- Optimus bright
- AQUOS PHONE f
- BlackBerry Bold 9780

- Android 2.3: 8 models
- FOMA max. speed 14Mbps: 6 models
- “Osaifu-Keitai” e-wallet: 5 models
- One-segment broadcasting: 5 models
- Infrared data exchange: 6 models
- Waterproof: 3 models
- Tethering: 7 models
Smartphone Sales Promotion

- Aim to sell 6.00 million units of smartphones in FY2011
- Reviewed internal organizational structure, etc., to promote smartphone sales

DOCOMO’s smartphone sales

<table>
<thead>
<tr>
<th>Product planning organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content development organization</td>
</tr>
<tr>
<td>Customer-front organization (increase of call center staff)</td>
</tr>
<tr>
<td>Billing-related</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Smartphone sales (target)</th>
<th>Standard phones (i-mode, etc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2010</td>
<td>2.52 million</td>
<td></td>
</tr>
<tr>
<td>FY2011</td>
<td>6.00 million</td>
<td></td>
</tr>
<tr>
<td>FY2012</td>
<td>10.00 million</td>
<td></td>
</tr>
</tbody>
</table>
Evolution of Smartphones

Transplant i-mode services into smartphones

Past actions

2011 Summer

2011 Winter & beyond

Integration of services

i-mode phones

Content, Music, Video, Game, Book

Smart phones

“sp mode”/ “Osaife-Keitai” e-wallet

“BeeTV”/Rakuten auction

“Disaster Message Board”/ “docomo Map Navi”…etc.

New services uniquely available with DOCOMO

“docomo market”

“docomo Palette UI”

“docomo Connected Home”

“i-channel”

“i-concier”

“Melody Call”

Content billing/authentication

G-guide TV program guide

“MyMenu”

“Area Mail”
Introduction of i-mode Billing Scheme in Smartphones

- High-quality i-mode content to become accessible via smartphones

Planned for launch in winter 2011

Prepare for introduction in smartphones

From winter 2011

Expand smartphone content

Introduce into smartphones i-mode billing/authentication scheme

Allow users to carry over "MyMenu"

No. of smartphone content

i-mode official sites

Wallpaper
Game
Video
Music
Characters
Horoscope

Deco-mail
Show biz
Sports
Character
Music
Horoscope

Game
Deco-mail
Video
Show biz
Sports
Character
Music
Horoscope
3-2. Introduction of “Xi” LTE Service and Evolution of Network
Transmission rates of both mobile and fixed-line networks projected to achieve an increase of approximately 1,600 times in 15 years.
Integration of Mobile Communications Systems into LTE

- LTE standardization started after DOCOMO’s proposal
- Operators around the world likely to adopt LTE, leading to global integration of mobile communications system

LTE standardization

2004
- Proposed by DOCOMO to standardization body 3GPP as an evolution of 3G system (“Super 3G” concept)

Dec. 2004
- Proposed jointly by 26 companies including DOCOMO, and approved at 3GPP meeting

Dec. 2008
- LTE standardization completed

Systems adopted by world carriers

USA
- AT&T
- Verizon

Europe
- Vodafone (UK)
- Orange (France)
- T-Mobile (Germany)
- Telefonica (Spain)

Japan
- DOCOMO
- SoftBank
- KDDI (au)

China
- China Unicom
- China Telecom
- China Mobile

W-CDMA
CDMA2000
TD-SCDMA

3GPP: 3rd Generation Partnership Project

*Source: Extracted from newspaper articles, etc. Inclusive of introduction plan under study
Response to Constant Growth of Packet Traffic

- Aim to accommodate constant growth in traffic by maintaining/improving our network quality through the introduction of LTE.
“Xi” (“crossy”) LTE Service Launch 【Demo at Exhibition】

- Commercial service launched on Dec. 24, 2010
- Plan to deliver various new services leveraging LTE’s “high-speed” “large-capacity” and “low-latency” transmission capabilities

■ Distinctive features of LTE

<table>
<thead>
<tr>
<th>Features</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-speed</td>
<td>Approx. 10-fold*</td>
</tr>
<tr>
<td>Large-capacity</td>
<td>Approx. 3-fold</td>
</tr>
<tr>
<td>Low-latency</td>
<td>1/4</td>
</tr>
</tbody>
</table>

(When compared to FOMA (HSPA) service)

LTE coverage to be expanded using an overlay approach to existing 3G areas

■ Service brand/logo

Xi (pronounced “crossy”)

■ Devices (data-only)

- Max. downlink speed: 75Mbps

USB type
ExpressCard type
Mobile Wi-Fi router type

* Comparison between HSPA max. downlink speed of 7.2Mbps and LTE max. downlink speed of 75Mbps
The most distinctive characteristic of LTE, “low-latency”, enables the provision of various “first-of-its-kind” services.

Enables advancement of services beyond the conventional limitation of implementation load in devices.

Collaboration between Devices and Network

LTE

Device

Sophisticated processing to be performed by network side

Network

Device processing

Device data
“Translator Phone” Service

- Makes it possible for the user to communicate in native language in a conversation with another person using a different language as if there is a translator in the network

Trial service with monitors (Planned to start in Nov. 2011)

Translator phone function

Japanese⇔English translation

Can hear the words of the other party in Japanese
Can hear the words of the other party in English
“Translator Phone” Service: System Image

- Makes it possible to execute high-load processing that cannot be performed by devices, by placing the translation function on the network cloud.
AR (Augmented Reality) Service

“Chokkan Navi” (intuitive navigation service)

Search and display nearby shops

Navigation to desired destination

* Provided by ZENRIN DataCom Co. Ltd.
• Aim to grow “Xi” LTE subscriptions to over 1.00 million in FY2011 by enriching product lineup
• Plan to spend ¥300.0 billion in “Xi”-related CAPEX in the first three years

**Enrichment of “Xi” product lineup**

- **FY2010**
  - Released Dec. 2010
    - USB type
  - Released Apr. 2011
    - ExpressCard type

- **FY2011/1Q**
  - Plannned for release: June-Jul. 2011
    - Mobile Wi-Fi routers

- **FY2011/2Q**
  - Plannned for release: Jul-Aug. 2011
    - Xi-enabled smartphone

- **FY2011/3Q and beyond**
  - Plannned for release: 2011 autumn
    - Xi-enabled smartphone
  - Plannned for release: 2011 autumn
    - Xi-enabled tablet

**Projected subscriber growth (conceptual)**

- **FY2010**
  - Released
  - FY2010
    - USB type: Apr. 2011
    - ExpressCard type: Dec. 2010

- **FY2011**
  - 1.00 million

- **FY2014 target:** 15.00 million

- **FY2014**
  - Planned

- **FY2014**
  - Target

- **0.026**
  - (Million subs)
**“Xi” LTE Area Expansion**

- **Planned CAPEX for first three years:** ¥300.0 billion

<table>
<thead>
<tr>
<th>FY2010</th>
<th>FY2011</th>
<th>FY2012</th>
<th>FY2013</th>
<th>FY2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Xi” LTE-related CAPEX: ¥26.0 billion</td>
<td>Approx. ¥100.0 billion</td>
<td>Approx. ¥170.0 billion</td>
<td>Approx. 35,000 Approx. 70%</td>
<td></td>
</tr>
</tbody>
</table>

- **Data-only devices**
  - Tokyo/Nagoya/Osaka: Approx. 1,100 Approx. 8%

- **Smartphones**
  - No. of base stations: Approx. 5,000
  - POP coverage: Approx. 20%

- **Tablet type devices**
  - Major cities across Japan: Approx. 15,000 Approx. 40%

- **Further area expansion**
  - Prefectural capital-size cities
  - Further area expansion

© 2011 NTT DOCOMO, INC. All Rights Reserved.
Further Evolution of Network

System performance

Bandwidth: up to 100MHz
- **LTE-Advanced**
  - Peak throughput: 1Gbps

Bandwidth: 5-20MHz
- LTE
- **HSPA (HSDPA, HSUPA)**
- **W-CDMA**

Timeline:
- 2000
- 2010
- 2015
Characteristics of LTE-Advanced

- A radio access system aimed for further advancement in transmission rates and capacity compared to LTE (Xi)
- Emphasizes compatibility with LTE to ensure smooth migration

### Distinctive features of LTE-Advanced

#### Further speed enhancement
- Max. downlink: **1Gbps**
- Max. uplink: **500Mbps**
- *More than 10 times higher* compared to 75Mbps (downlink)/25Mbps (uplink) of LTE (Xi)

#### Wider bandwidth
- Supports bandwidth of up to 100MHz by using multiple carrier frequencies

### System migration (conceptual)

- Complete development in 2015 (target)
- *LTE-enabled devices can handle communication using LTE on “as is” basis even in LTE-Advanced areas*
LTE-Advanced Trial

- Developed experimental system based on 3GPP LTE Release 10
- Realizes transmission rate of 600Mbps (downlink) and 200Mbps (uplink) in outdoor environments

Verification trial (Outdoor experiment: image)

Complete development in 2015 (target)

2X2 MIMO applied
MIMO: Multiple Input Multiple Output
Multiband Power Amplifier

- Developed prototype of radio circuit that is expected to contribute to globalization of mobile handsets
  - Multiband support: 9 bands in 0.7GHz-2.5GHz including 1.5GHz band
  - Multi-mode support: 3 systems of GSM, W-CDMA and LTE

Complete development in 2013 (target)

【Characteristics】
Miniaturized to a level that can be implemented in handsets, while securing performance equivalent to currently used single-band power amplifiers

【Spectrum allocation for mobile phones in different markets】
3-3. Cultivation of New Business Fields
Promotion of Converged Services

- Deploy new service converging mobile phones with various life tools

Industrial equipment
Automobiles (ITS)
Information appliances
Broadcasting
Fixed line

Feature phone
Smartphone
Communication module
Convergence with ITS ("docomo Drive Net", Nissan LEAF)

- Deliver various information to cars equipped with personal navigation devices (PND) or communication modules, in light of full-scale expansion in the adoption of car electronics.

**"docomo Drive Net" (Exhibited)**
Information delivery service to PNDs, smartphones

- Latest map
- Traffic info.
- Latest area info.

**Car-mount cradle**

**Convergence with electric vehicle**
Provision of online connectivity in Nissan’s electric vehicle “LEAF”

**PND**

GSMA 2011
“Global Mobile Award”

- In-vehicle IT support
- Remote control
Convergence with Information Appliances (E-Book Service)

- Joint promotion of electronic publishing business with Dai Nippon Printing, Co. Ltd. (DNP)
- Established joint-venture company (2Dfacto) and started full-scale service on Jan. 12, 2011

**E-Book Store**

Provision of approx. 20,000 content titles

【Future development (conceptual) 】

- Coexistence of physical/digital stores -

  ● One-stop management of physical & electronic books (bookshelf service)

  ● Point sharing between physical/digital store

Established joint venture company (2Dfacto) with DNP.
Full-scale service launched on Jan. 12, 2011
Finance/Payment Business: Advancement of “Osaifu-Keitai” e-Wallet

Aim to support various services available in other markets worldwide, by making FeliCa-enabled “Osaifu-Keitai” compatible with NFC

- Compatible with services available in other markets
- Compatible with existing FeliCa services

Current system

FeliCa-enabled services

FeliCa wireless chip

FeliCa-enabled services

Type A/B-enabled services

NFC wireless chip

Transition period

2012 (planned)

Embed in SIM

SIM card system

(Type A/B/FeliCa)

Type A/B/FeliCa-enabled services

NFC wireless chip

Embed in SIM

Type A/B/FeliCa-enabled services

NFC wireless chip
4. New Corporate Vision

“HEART”
Vision for 2020: Pursuing Smart Innovation

In the past decade, we have been pursuing the possibilities of mobile.

This decade, we will evolve into an “integrated service company” with mobile at its core.

“Pursuing Smart Innovation”

HEART

HARMONIZE: Social contribution beyond borders, across generations

EVOLVE: Evolution of service and network

ADVANCE: Advance industries through convergence of services

RELATE: Creating joy through connections

TRUST: Support for safe, secure and comfortable living

MAGIC

Mobile Multimedia
Anytime, Anywhere, Anyone
Global Mobility Support
Integrated Wireless Solution
Customized Personal Service

2000 - 2010

2010 - 2020
Technologies to support Smart Innovation

**Cognitive**
- Behavior economics
- Autonomous agent
- Service science

**Service and Platform Technology**
- Digital Rights Management
- ID management
- Personalized speech synthesis
- Personalized speech recognition
- Handwriting recognition
- Hand-written font synthesis
- Social Influence Analysis
- Real-time machine translation
- Behavior prediction
- Data mining
- Recommendation
- EV-ITS
- Car security
- Networked Appliance control
- IPTV

**Networking Technology**
- LTE Advanced
- Heterogeneous network
- Carrier aggregation
- Self Organizing Network
- Coordinated Multipoint Transmission
- Cognitive radio
- Advance MIMO
- Relay
- Beyond LTE
- Near Field Communication
- 3D/Streams (user interface)
- Micro-scale sensor
- Brain-machine interface
- Invisible (ultra-small) interface device
- Fuel cell
- Wearable device
- Advanced lithium battery
- Metal-air electrochemical cell

**Terminal Technology**
- Software Defined Radio
- Thin client
- Unified Speech and Audio Coding
- High-performance Video coding (H.265)
- 3D audio/video
- Solar energy cogeneration
- Haptic communication
- Teleoperation

**Robotics**
- Nanometer/compound
- Network virtualization
- Rich Communication Suite
- (Mobile) Network APIs
- Cloud security
- New generation network (Future Internet)
- Microelectromechanical systems
- Meta-materials
- Nano-supercapacitor

**Bio**
- Molecular communication
- Biochemical sensor
- Micro TAS

**Nano/material**
- Cognitive
- Brain-machine interface
- Meta-materials
Unlimited Potential, in Your Hand