A Force Feedback Remote Ultrasound Service

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Origin & Objectives

o   E-Health Services

o   Public health / Country Planning

o   Telemedicine: Homecare, Remote diagnosis, Remote examination, Remote surgery

o   Improvement of healthcare supply organisations

o   Promotion of:

1. collaborative working
2. proficiency networks

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The French panorama

o 39 « level 3 » services in general hospitals

o 300 « level 2 » medical centres
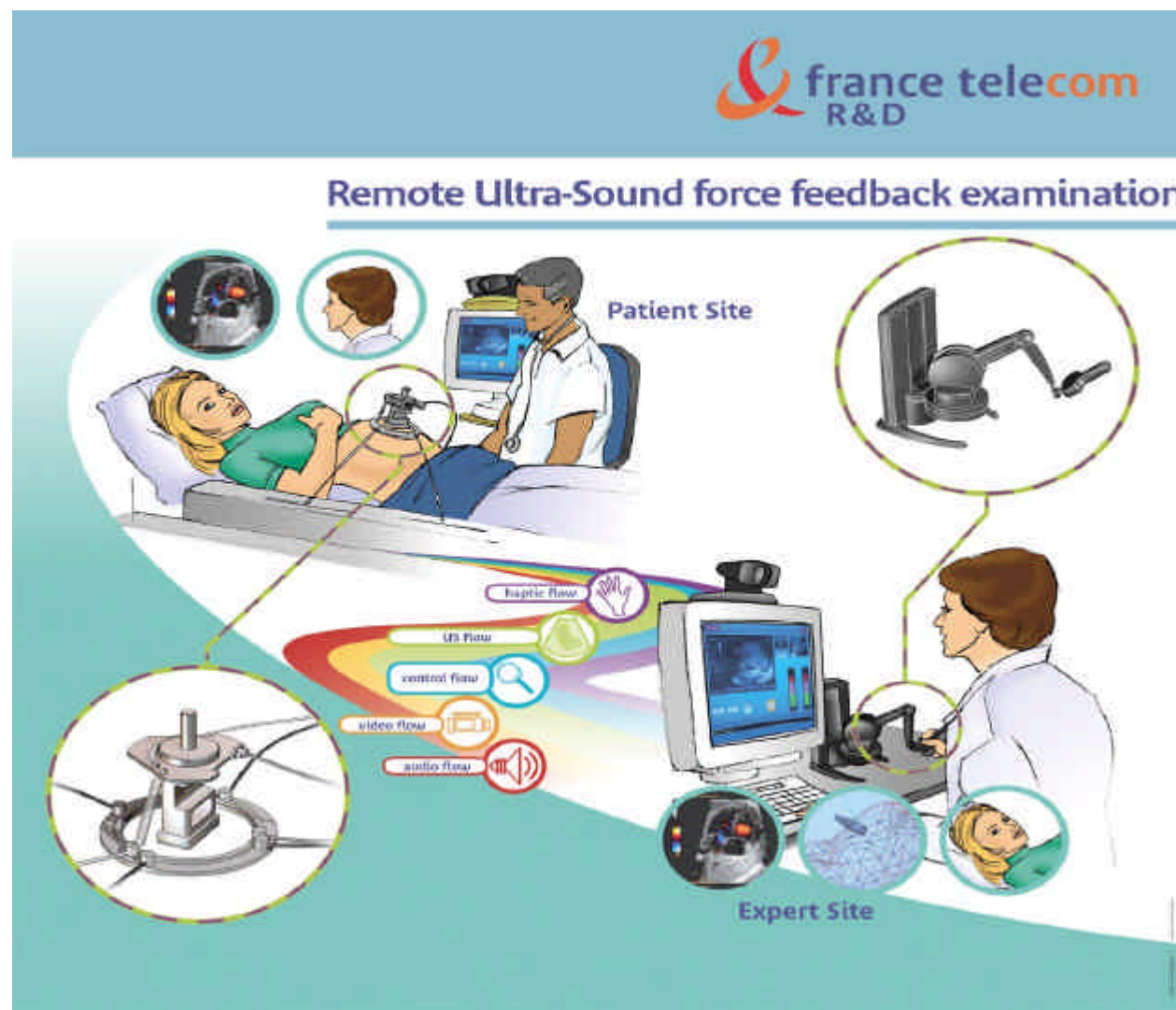
o 2500 « level 1 » medical studies

Organisation

o 2 complementary teams at France Télécom R&D:

1. Development of telemedicine services prototypes

2. Research on haptic interfaces and tele-gesture

o External partners

1. Universities: robot control

2. Industrials: making of robot device

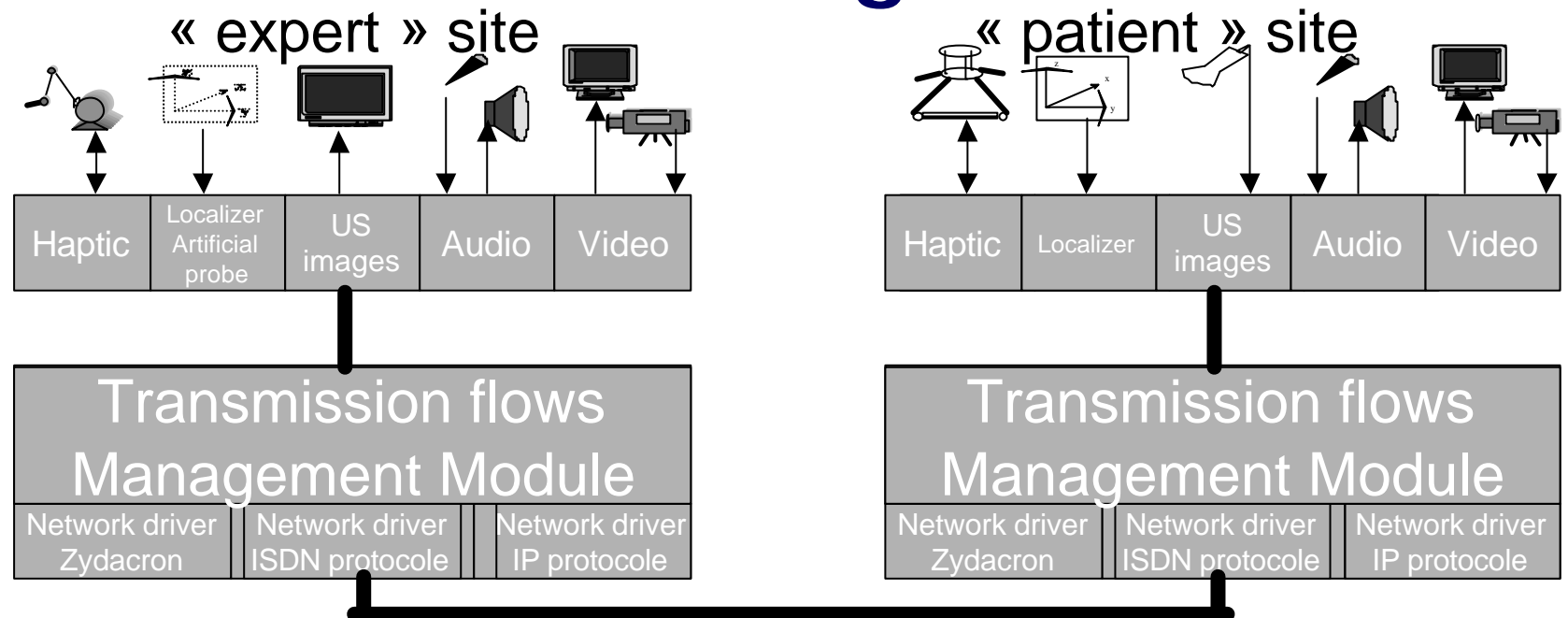3. Medical staff: clinical validation

Architecture of the service

o Point to point service linking:

1. a « patient » site: Patient + medical personnel, video, robot, US device

2. an « expert » site: Medical expert, visio, haptic device, image visualisation

o Different Flows ... and constraints:

1. Informal communication: Audio/video

2. Diagnosis: Medical images

3. Robot control and gesture: Haptic data

How does it work

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Flow Management

« expert » site

« patient » site

Haptic	Localizer Artificial probe	US images	Audio	Video

Haptic	Localizer	US images	Audio	Video

Transmission flows Management Module

Network driver Zydacron	Network driver ISDN protocole	Network driver IP protocole

Transmission flows Management Module

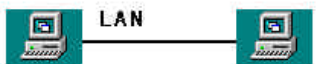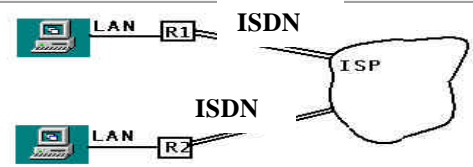| Network driver Zydacron	Network driver ISDN protocole	Network driver IP protocole

1. Integration of all the flows on one hardware platform
2. Handling of the requirements specific to each flow (delays, rates, priority)
3. Handling of the necessary dependency between flows (synchronisation)
4. Modularity -> ISDN, ADSL, ATM, GPRS, UMTS

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Transmission of Touch

o use of robotics for robot tele-operation and haptic for "rendering" the force exerted by the robot.

o The transport of the gesture data allows an immersion even more complete and realistic for distant manipulators.

o The haptic command station preserves medical expert proprioception and gesture feelings

Networks:

ITU-T

Validation on several « smart » network configurations

Configuration	Delay Jitter	Band Width	Deploy-ment	Services
	< 1ms Low	Large	No, or limited & dedicated offers	Tele expertise, e-learning specialty networks
ISDN	~5ms Low	Up to 512kbps	large	Tele expertise
ISDN	~15ms Low	Up to 512kbps	large	Tele expertise in proficiency networks
ISDN	25ms High	Limited by the ISP	large	Tele expertise with low quality images
GPRS / UMTS	High		large	Emergency

Challenges & Innovation

o **5 patents**
   1. Exact gesture transmission
   2. Synchronisation of heterogenous flows
   3. Generic module for remote virtual reality

o **Wide openning**
   1. Equipments: peripherals, robots
   2. Telecommunication networks

o **Simultaneous innovation:** Uses & Services

o **France Télécom R&D Innovation Awards**

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Other Applications

o   Proprioceptive telemedicine

    1.   Tele-expertise:
        Isolated sites, Medical Urgency

    2.   Nano surgery

    3.   Remote surgery

o   Networking games

o   Industrial remote handling

o   E-learning for gesture

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Illustration

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