TNO ICT
Research interests

Remco Litjens

TNO | Knowledge for business

ERCIM eMobility kickoff
October 27, 2006
Basel, Switzerland

TNO

A CONTRACT RESEARCH ORGANISATION

- About TNO
  - Founded by law in 1930
  - Partner in innovations
    (e.g. assistance of companies that have no in-house R&D)
  - Independent of public and private interests
- Features
  - Many disciplines under one roof
  - Expertise from concept to innovation
  - International footprint and client base
- Key figures*
  - Annual turnover: EUR 553 mln
  - 5100 employees

* in 2003

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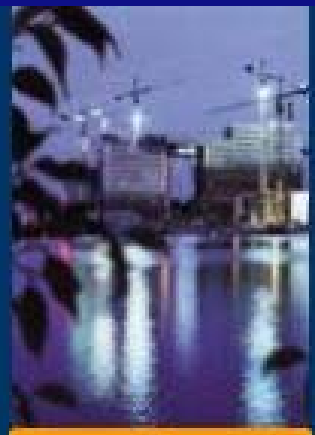
ACTIVE IN FIVE CORE AREAS

TNO Quality of Life

TNO Defence, Security and Safety

TNO Science and Industry



TNO Built Environment and Geosciences

TNO Information and Communication Technology

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TNO ICT

- About TNO ICT
  - Established on January 1, 2003
  - Bundling of former KPN Research with TNO's ICT related departments
  - One of the largest ICT knowledge centers in Europe
- Features
  - ICT: both Telecom and IT
  - Multi-disciplinary: technical, economical, sociological
  - Contract research & consultancy
    - For both industry & government
    - Diverse labs, test centers
- Key figures*
  - Annual turnover: EUR 40 mln
  - 375 professionals, average age 36
  - Locations in Delft, Groningen & Enschede

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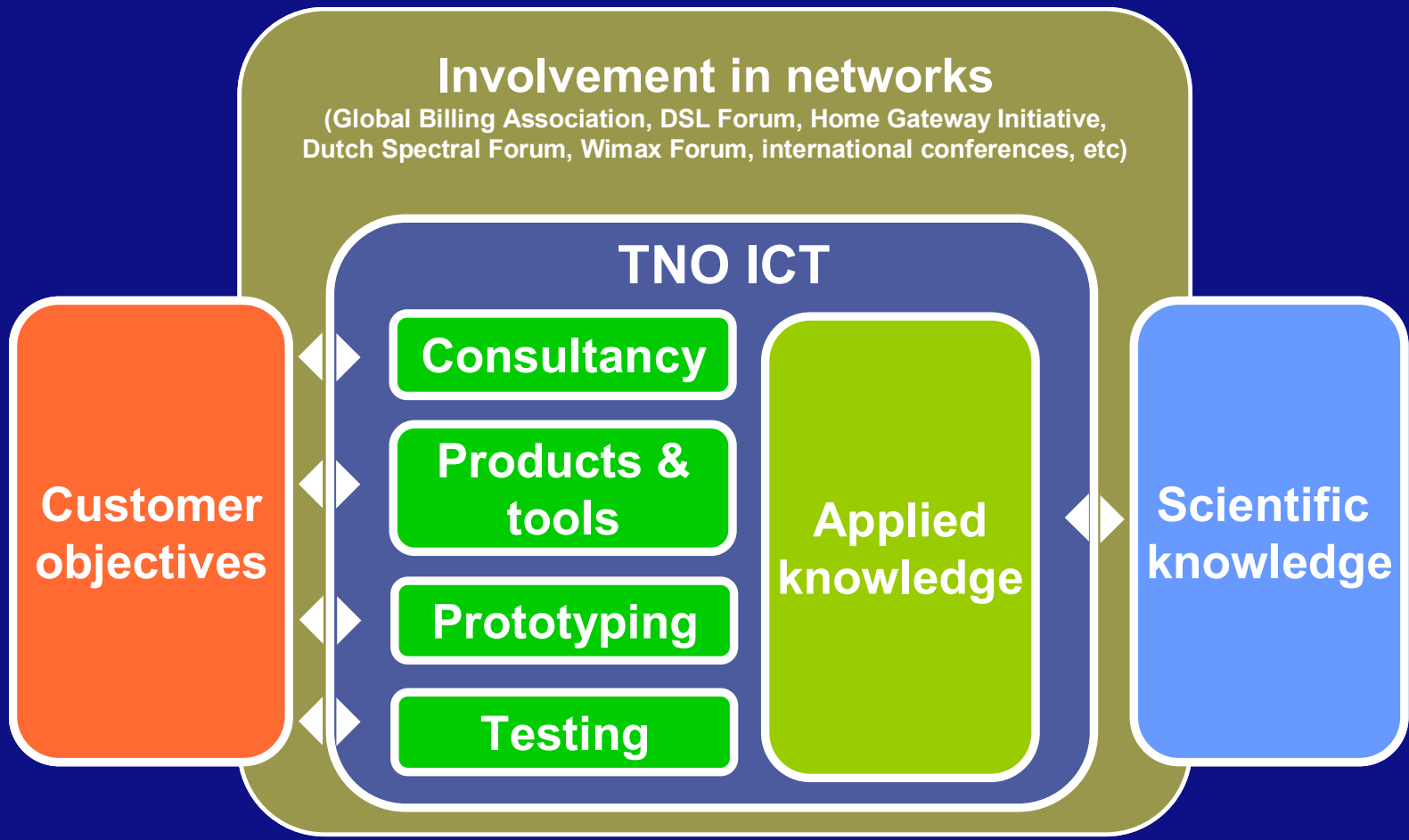

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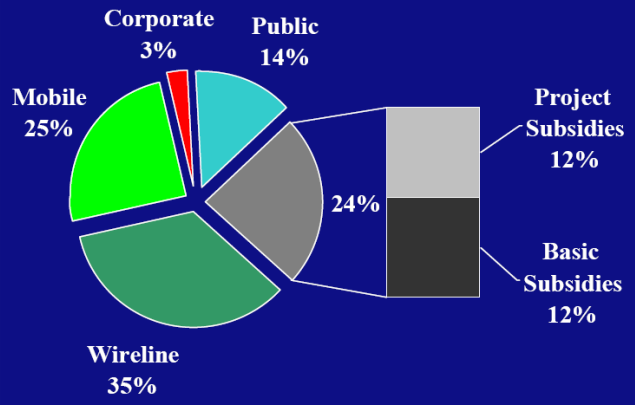

- Diverse markets
  - Wireline e.g. operators, vendours
  - Mobile e.g. operators, vendours, industry fora
  - Corporate e.g. energy sector, banks, transport/logistics, SME
  - Public e.g. regulator, defense, health sector

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- **Expertise/knowledge innovation**
  - **(Inter)na(tion)al cooperations**
  - **Universities, research labs**
    - Expertise center e-Quality, part-time professorships
  - **(Inter)national research projects**
    - COST 290
    - IST FP6: Ambient Networks
    - ITEA: Easy Wireless
  - **Standardisation activities**
    - ITU
    - 3GPP

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PLANNING, PERFORMANCE, QoS

- Focus
  - Technology assessment, experiments
  - Network planning and dimensioning, capacity management
  - Design, evaluation, optimization of QoS control mechanisms
  - Performance monitoring
  - Evaluation/prediction of perceived end-to-end QoS
  - SLA specification
- Application areas
  - Mobile/wireless networks
  - Fixed networks
  - IT systems
- Approaches
  - Analysis - Queueing models
  - Simulations - Delphi, Matlab, NS2, OPNET
  - Experiments - measurements, monitoring

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PLANNING, PERFORMANCE, QoS

- Technologies
  - 802.11a/b/e WLANs
  - 802.15.4 WPANs
  - 802.16e mobile WiMax
  - UMTS/HSPA
  - LTE (OFDM)
  - Ad hoc networks
  - Sensor/actuator networks
  - Multi-access networks
  - Hybrid networks
- Operations perspective
  - Performance assessment
  - Impact on network planning
  - Optimization of QoS control mechanisms

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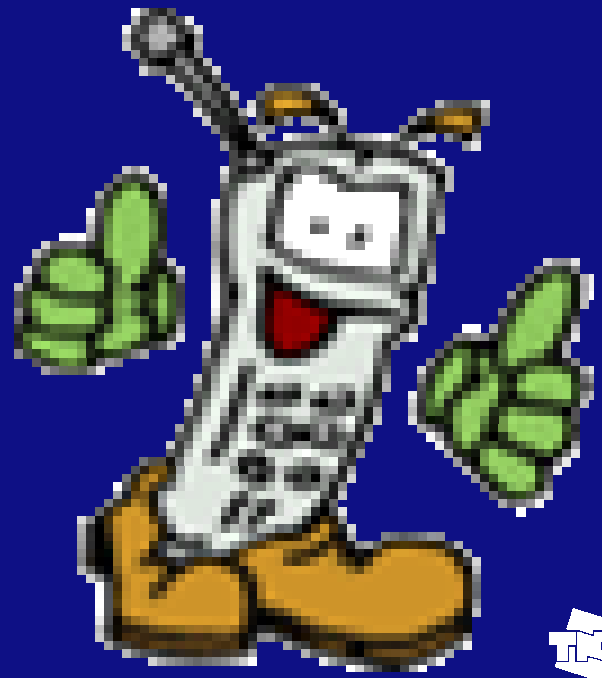
PLANNING, PERFORMANCE, QoS

- **Some recent/current example studies**
  - **HSDPA**
    - Technology assessment, performance modelling & analysis, assessment of opportunistic scheduler, derive impact on network planning, assessment/validation/development of planning module, …
  - **EUL**
    - Technology assessment, performance modelling & analysis, …
  - **Ad hoc networks**
    - QoS differentiation, power control for throughput enhancement, performance modelling & analysis of a bottleneck node; development of testbed, emulations, simulations, analysis for performance evaluation/optimisation, …
  - **Multi-access networks**
    - Assessment of multi-access diversity gain, trunking gains, impact of (non-)cositing, switched vs parallel multi-radio transmit diversity, …
  - **OFDM networks**
    - Propagation modelling, network planning, opportunistic scheduling/subcarrier allocation, …

PLANNING, PERFORMANCE, QoS

- **Primary interests for new cooperations, e.g. IST FP7**
  - **Planning, performance & QoS of OFDM-based networks**
    - E.g. 3GPP LTE, (mobile) WiMax
  - **Planning, performance & QoS of ad hoc/sensor/actuator networks**
  - **Planning, performance & QoS of UMTS/HSDPA/EUL networks**



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