UK-China Science Bridges: R&D of 4G Wireless Mobile Communications

International Center for Wireless Collaborative Research

An Introduction of

Shanghai Research Center for Wireless Communications (WiCO)

Outline

- About WiCO
- National Key Special Programs in Science and Technology
  - New Generation Mobile Wireless Broadband Communication Networks
- Our Research Focuses and Collaboration Opportunities
- Conclusions

WiCO: Shanghai Research Center for Wireless Communications

- Science and Technology Commission of Shanghai Municipality
- Changning District Government, Shanghai
- Chinese Academy of Sciences (CAS), Shanghai Institute of Micro-system and Information Technology
- Southeast University

→ International Center for Wireless Collaborative Research

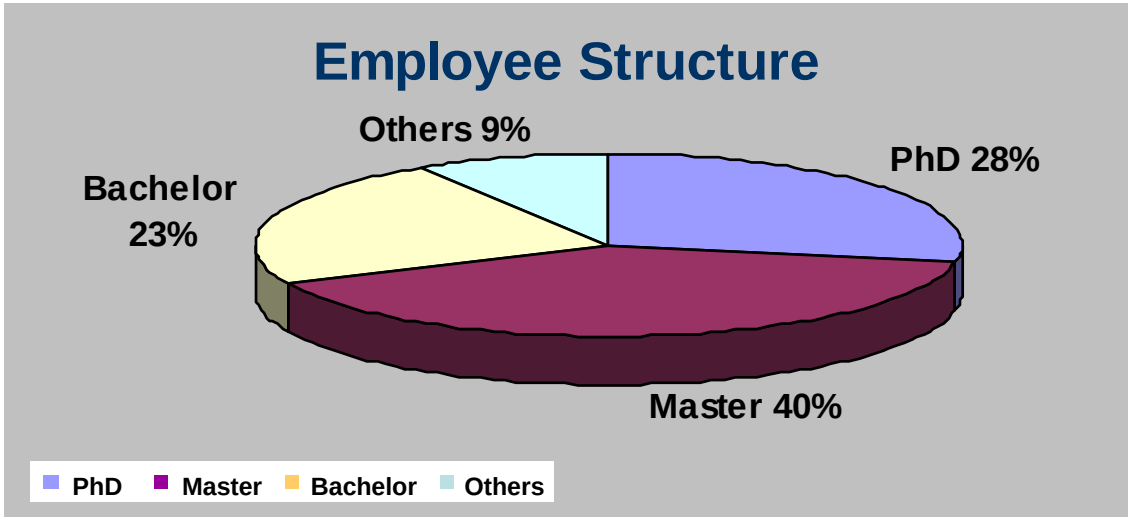
→ International Collaboration Base of Science & Technology

→ Research and Engineering Center for Broadband Wireless Communication Technologies, STCSM

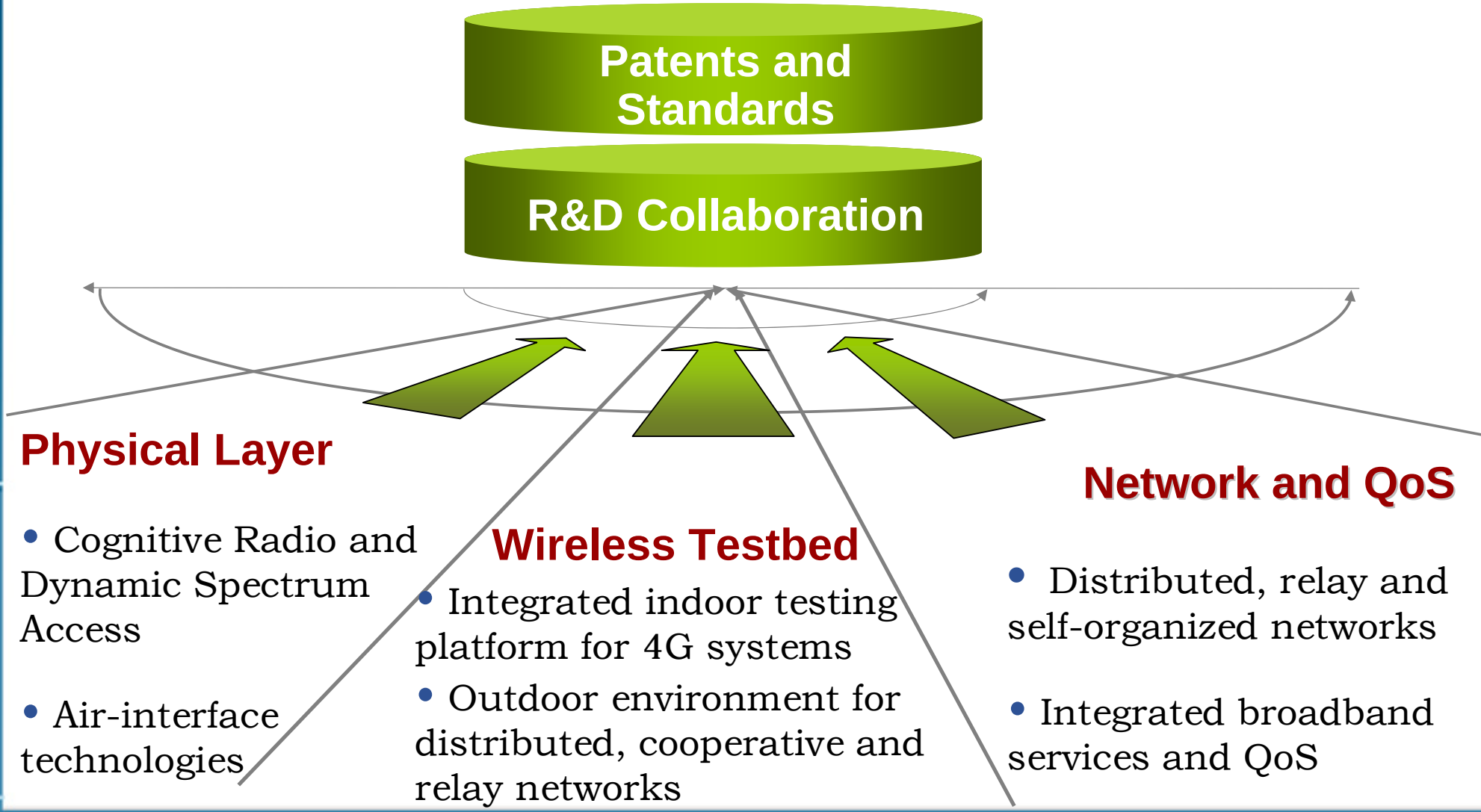
→ Key Laboratory of Wireless Sensor Networks and Communications, CAS

Team

- 70 employees
- 20+ PG students
- 3 Post-docs
- Visiting researchers and adjunct professors



Research Areas



Physical Layer

- Cognitive Radio and Dynamic Spectrum Access
- Air-interface technologies

Wireless Testbed

- Integrated indoor testing platform for 4G systems
- Outdoor environment for distributed, cooperative and relay networks

Network and QoS

- Distributed, relay and self-organized networks
- Integrated broadband services and QoS

Current and Recent Projects

- Total: 54 projects (22 international projects)
- Budget: ~101M RMB

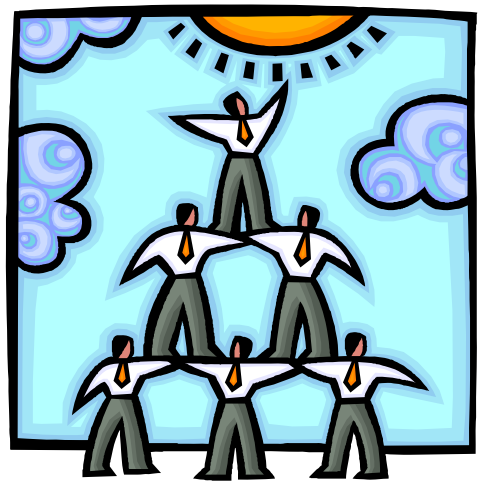
Funding Organizations	Project Name
STCSM	Research on the Key Technologies
STCSM	Research, development, and demor systems
STCSM	Solution schemes and evaluation towards future mobile communicat
STCSM	Shanghai Technical Research Cent Engineering
STCSM	The Key Technologyies R&D of the the Construction of Integrated T
STCSM	Research on Air Interface of 4G
STCSM	Mobile Relay Technologies and St
STCSM	Research on Key Technologies in
MOST	B3G System Testing and Field Trial Networking Technologies
MOST	B3G Integration Testing Platform
MOST	R&D on B3G Service Demonstration Platform
MOST	The Asymmetrical FDD Radio Frequency Technology for the Fourth Generation Mobile Communication System
MOST	Research on Air Interface, Network Architecture and Prototype Implementation of Personal Adaptive Global Network
MOST	Broadband Wireless Access Terminal Analysis, Deployment and Air Interface Evolution Strategies
MOST	My Personal Adaptive Global Network
MOST	Research on a Single-Carrier Multiple Access Scheme based on Filter Bank
MOST	Research on Key Technologies in the Wireless Communication System of Personal Network
MOST	Investigations on key technologies for wireless infrastructured ad hoc networks
MOST	MU-MIMO Generalized Frequency Division Multiple Access Technologies
CAS	Research on Air Interface of B3G/4G

R&D Projects on 4G Technologies

Project Title	Funding Body
Research on key technologies of 4G	STCSM
Research on the air interface, network architecture and prototype implementation of personal adaptive global network	National 863
3GPP LTE Evolution Activities	CEA-LETI
Beyond 3G System Integration Platform and Field Trial Environment	National 863
B3G/4G Standardization Research	NOKIA
Multiple Antenna Systems for Wireless Communication （Phase I）	ERICSSON

R&D Partners and Sponsors

University partners	Industry partners	Industry organizations
Southeast university	Huawei	Institute of Computing Technology, CAS
Shanghai Jiao Tong University	ZTE	Institute of Acoustics, CAS
Zhejiang University	China Unicom	SIMIT, CAS
Shanghai University	China Telecom	Future Forum
Fudan University	China Mobile	CCSA
East China Normal University	NOKIA (Finland) Ericsson (Sweden)	PROMPT
Tsinghua University	B-Star	Mobile-VCE
University of Electronic Science and Technology of China	Siemens (Germany) France Telecom	CEA-LETI
Beijing University Of Posts and Telecommunications	Shanghai Alcatel Boeing	RITI
Xi'an Jiaotong University	Wavesat	……
Huazhong University of Science & Technology	British Telecom Agilent HUT Oulu	
China Science & Technology University	École de technologie supérieure Royal Institute of Technology University College London Uppsala University	
Tongji University		
Shandong Univ.		



International Collaborations

WiCO-Nokia, 2004

WiCO-Ericsson, 2004

WiCO-Siemens, 2005

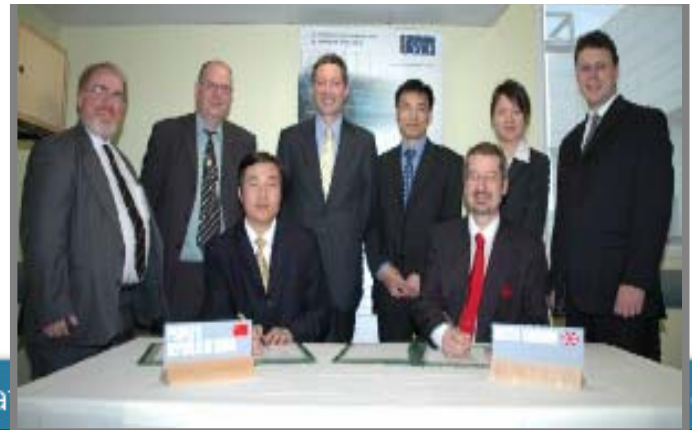
WiCO-CEA-LETI, 2005

WiCO-France Telecom, 2005

WiCO-PROMPT, 2006

WiCO-Mobile VCE, 2005

UK-China Science Bridges, 2008



International Joint Research Labs

Remote Research Collaboration Facility (RRCF)

China-Quebec Academic-Industry Alliance

- China-Quebec academic-industry R&D on bottleneck technologies
- A platform to accelerate patents to be transferred to market with lower cost and high profits

WiCO-Nokia Joint Research Laboratory

Technology Alliance

- Research on 4G key technologies
- More patents for international standards
- Specialist committees; visiting professors

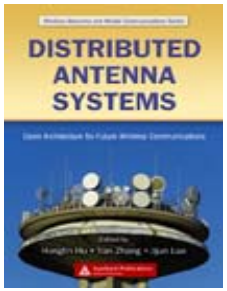
Research Outcomes (2003-2008)

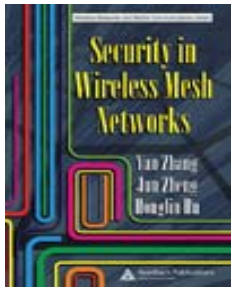
111 patents; *5* books; *85* articles; *70* standard proposals

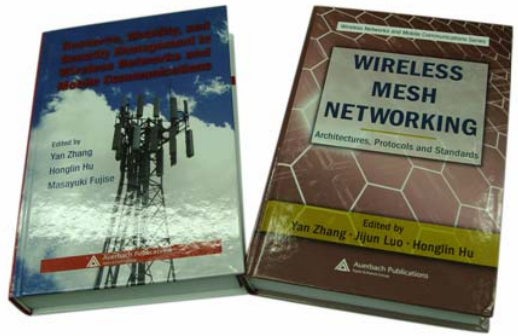
发明名称	申请号
一种分层软小区无线网络及其接入控制方法	PCT/CN2004/000772
一种正交频分复用系统中的信号均衡方法	200410066488.4
一种多发射多接收天线正交频分复用发射/接收机	200410084227.5
一种基于速度和位置的无线通信系统的切换方法	200410089455.1
一种自适应滤波方法及装置	200410089454.7
一种多载波	一种基于多带滤波器组的正交复用多载波发射、接收装置及其方法	200510026962.5
正交频分复用	一种基于多带滤波器组的正交复用多载波传输降低峰均比的装置及其方法	200510026964.4
一种通信系统	基于多子带滤波器组的单载波频分多址发射、接收装置及其方法	200510029196.8

Conference	Tdoc Number	Title
Athens, Greece, 9 – 13 May, 2005	R1-050480	Downlink Multiple Access Scheme for Evolved UTRA
	R1-050481	Uplink Multiple Access Scheme for Evolved UTRA
Quebec, Canada, 30- 31 May 2005	REV-05063	An Introduction To MBFB Based VMC for Uplink of EUTRA
	REV-05064	An Introduction To OFTDM Based VMC Scheme
Sophia Antipolis, France, 20–21 June, 2005	R1-050609	GMC Transmission Technique for E-UTRA systems
	R1-050610	Adaptive dual cyclic timeslot structure for E-UTRA systems
	R1-050662	GMC based interleaving FDMA for E-UTRA
	R1-050663	OFTDM transmission scheme in GMC sub-band for E-UTRA
London, UK, 29 August – 2 September, 2005	R1-050781	GMC Transmission Scheme and Parameters for Evolved UTRA Uplink
	R1-050782	Text Proposal: GMC Based Uplink Basic Transmission Scheme for TR 25.814
	R1-050784	Unifying MIMO for E-UTRA
	R1-050785	Text Proposal: Pilot Structure Used in Single Carrier Transmission for E-UTRA Uplink
San Diego, USA,10–14 October, 2005	R1-051132	Further considerations and Simulations of Unifying MIMO for Evolved UTRA
	R1-051133	DFT-S-GMC: GMC based SC-FDMA for 3GPP LTE uplink
	R1-051134	On the implementation of DFT-S-GMC
	R1-051135	Performance comparison between DFT-S-GMC and DFT-S-OFDM
Seoul, Korea, 7-11 Nov, 2005	R1-051384	Further description of DFT-S-GMC implementation
	R1-051385	Further simulation results of DFT-S-GMC in comparison with DFT-S-OFDM
	R1-051386	On the PAR/CM performance of DFT-S-GMC
	R1-051387	Bandwidth Efficiency Aspects of DFT-S-GMC

论文题目	会议名称	作者
aptive Transmission Mode Selection Scheme for stributed Wireless Communication Systems	IEEE Communications Letters,	Honglin Hu, Martin Weckerle, and Jijun Luo
aptive Frequency-Domain Interference Cancellation and annel Equalizer for MIMO-CP-CDMA Systems	in Proc. IEEE WCNC 2006, pp.1573-1577, 2006	Jing Xu, Haifeng Wang, Shixin Cheng, Ming Chen, Zhiyong Bu
timal Regions Planning for Adaptive Transmission Mode lection Scheme	in Proc. IEEE GLOBECOM 2006, .	Honglin Hu, Huiyue Yi, Mingqi Li, Xiaodong Zhang
duced CQI Feedback Signaling wnlink Multi-Stream MIMO Trans	DFT Spread Generalized Multi-Carrier Scheme for Broadband Mobile Communications	PIMRC 2006	Xiaodong Zhang, Mingqi Li, Honglin Hu, Haifeng Wang, Bin Zhou, and Xiaohu You
vel Bi-orthogonal Filter Ban ter-Bank Based Transmission	未来移动通信系统中的小区间干扰协调技术	电信科学	陈斌 胡宏林 张小东 卜智勇
	基于 DFT 扩频的广义多载波频分多址上行链路传输方案——DFT-S-GMC	电信科学	李明齐，张小东，李元杰，周斌
vel SINR Analysis for Adaptive dulation and Coding in General rrier Systems	基于 simulink 的分布式 mimo ofdm 无线通信仿真	系统仿真学报	周斌，姚勇，张小东
nt channel estimation and ca cking in the Evolved UTRA uplink	Complexity-Reduced Multistage Detection for MIMO Systems Using Sphere Decoding	ICWMMN 2006	Wei Zhao, Fan Wang，Yong Xiong
novel time domain channel estim nchronization errors	Layer Extrinsic Information Transferring (LEXIT) Detection Algorithm for Diversity MIMO Systems	IET ICWMMN'06	Xiumei Yang Xiaomei Xia Yong Xiong
	Novel Complexity Reduced Sphere Decoder in MIMO systems	ISSSTA	Xiaomei Xia Xiumei Yang Yong Xiong Jormal,Eeberg
于单载波 OFDM 系统的有效信干	移动无线通信网安全机制分析	中文期刊：信息安全与通信保密	郑明宏，刘光宇，卜智勇
	An Improved MIMO Single-Carrier MMSE Frequency-Domain Equalization for Space-Time Block Code	IST summit 06	汪凡 姚勇
esource, Mobility and Security M tworks and Mobile Communicatio	A Bidirectional Adaptive Detction for BLAST Systems Based on Deterministic Sampling	ICCCAS06	汪凡 姚勇
	多天线系统空间自适应调制通近检测算法	浙大学报工学版	汪凡 姚勇 张小东
ireless Mesh Networking: Archit andards,	A Bidirectional Adaptive Sequential Gaussian Approximation for MIMO Systems	VTC	汪凡 赵巍 姚勇
nt Design for LDPC Coded aptive Antenna	An Effecient Algorithm for MIMO Detection	ICWMMN2006	汪凡 赵巍 姚勇
mulanji-Based JAFE Algorithm in mporally Correlated Gaussian No	Multistage Sequential Gaussian Approximation for MIMO Systems	ICWMMN2006	汪凡 赵巍 姚勇
	The Multi-level Mapping Sequential Gaussian Approximation for MIMO Detection	Wlcom2006	汪凡 赵巍 姚勇
	Ordered Group Interference Cancellation for Quasi-orthogonal Space Time Block Codes	Wlcom2006	汪凡 赵巍 姚勇
	An Efficient Peak-to-Average Power Ratio Reduction Algorithm for WiMAX System，	APCC 2006	姚丽娟
	FuTURE R3G 系统现场集成试验	移动通信	王萍
	基于业务模拟的 B3G 系统网络性能测试方法	计算机工程	钱红燕

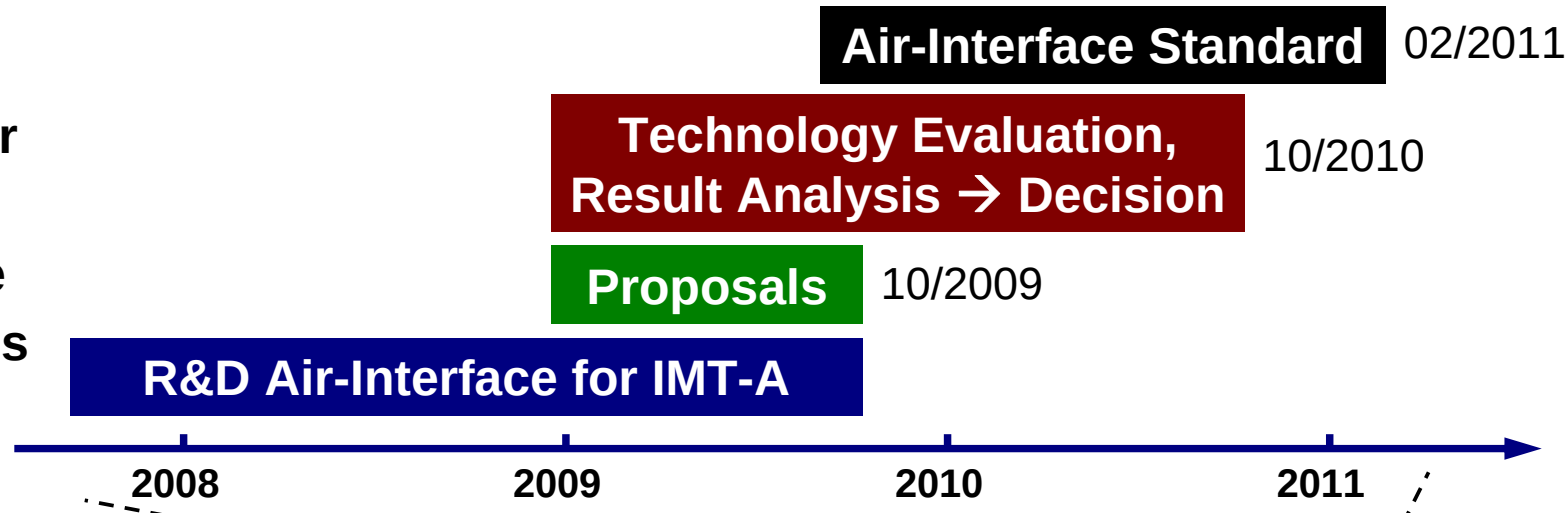




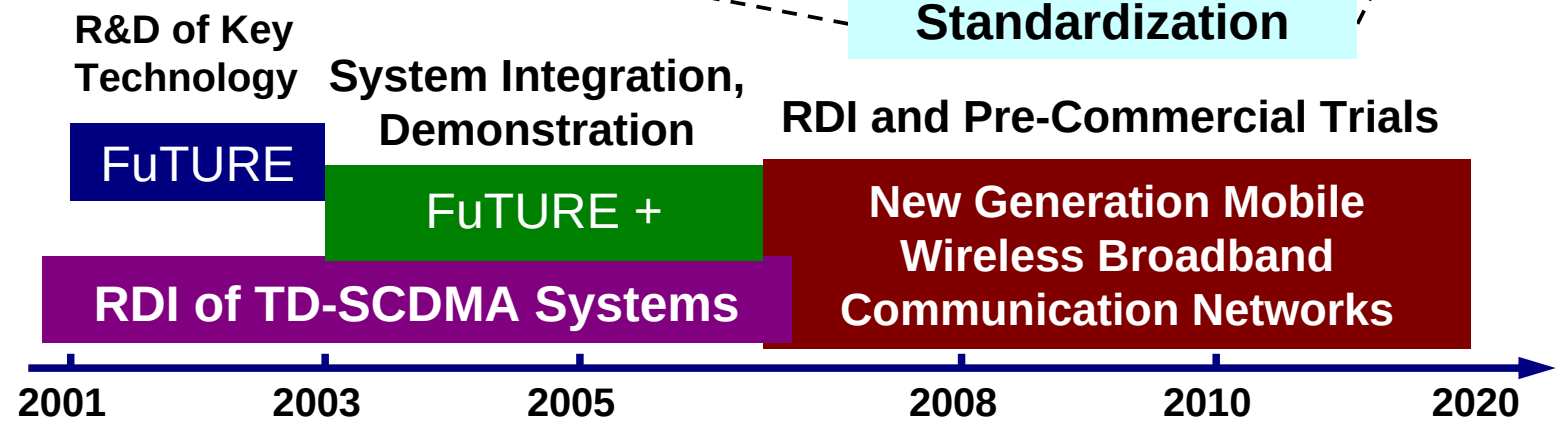


International and National R&D Activities towards Future Mobile Wireless Broadband Communication Networks

ITU-R time schedule for developing air-interface technologies for IMT-A



RDI of 3G and future mobile systems in China



Mobile Wireless Broadband Communication Networks

- Research, Development and Industrialization (RDI) of Enhanced TD-SCDMA Systems (10+8 projects)
- RDI of LTE Systems (14 projects)
- RDI of IMT-Advanced Systems (11 projects)
- Mobile Networks, Services and Applications, and the R&D of Mobile Terminals (7 projects)
- RDI of Broadband Wireless Access Systems (3 projects)
- RDI of Short-Distance Wireless Interconnection and Wireless Sensor Networks (10 projects)
- RDI of Key General Technologies for Wireless Mobile Communications, Project Management Support (4 projects)

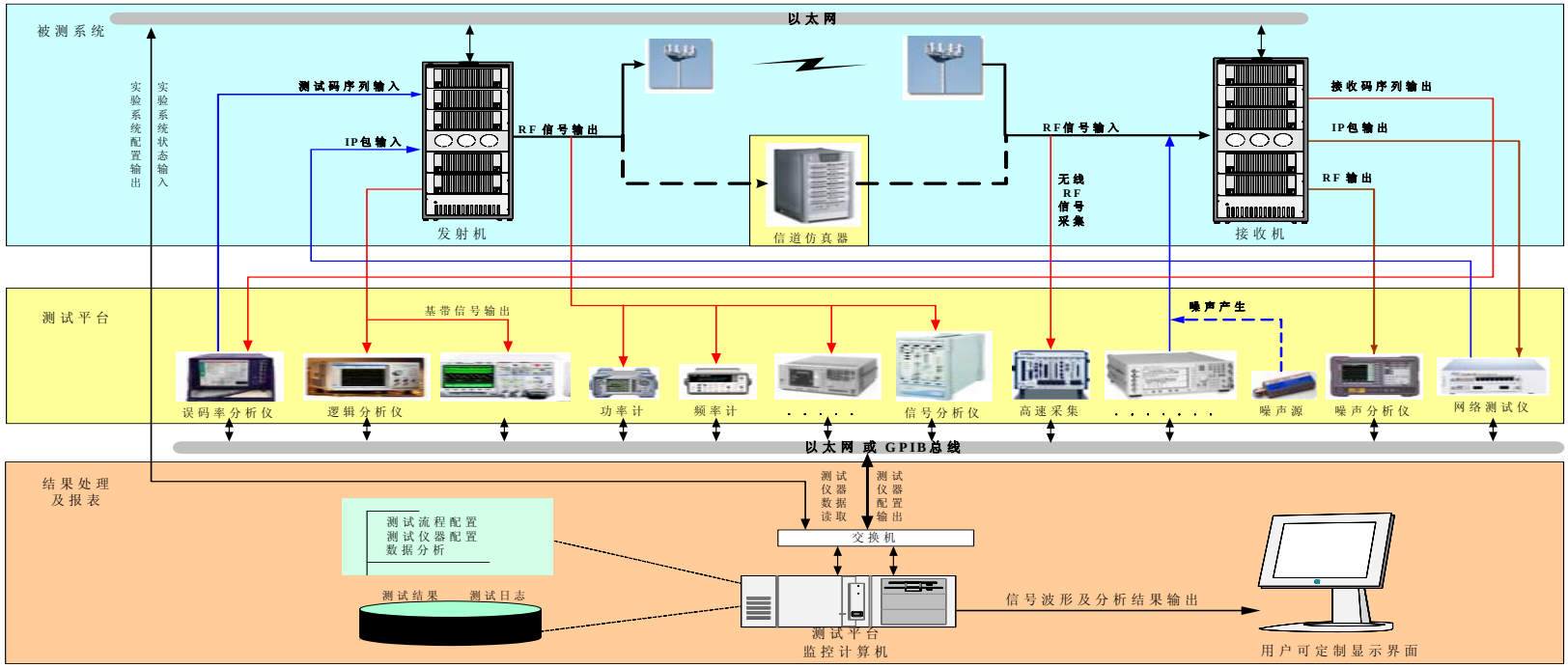
7 Research Areas and 67 Projects

Mobile Wireless Broadband Communication Networks

- WiCO has been involved in several collaborative research proposals
  - R&D of Baseband Chips for TD-LTE Mobile Terminals (PI)
  - A Wireless Testing and Evaluation Platform for IMT-Advanced Key Technologies (PI)
  - R&D of Relay Technology for IMT-Advanced Systems (PI)
  - and other key proposals as a Collaboration Investigator (Co-I)

Integrated Indoor Testing Platform

- A VISA-based open, shared and flexible testing environment
- It covers wireless channel measurement and modeling, wireless transmission performance (RF and baseband), wireless networking protocols, wireless services and QoS



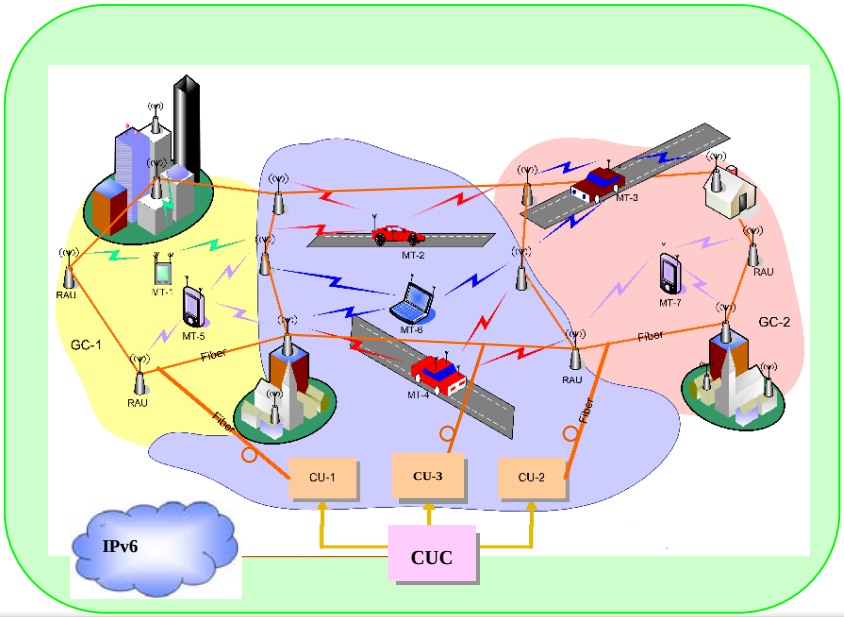
System Under Test

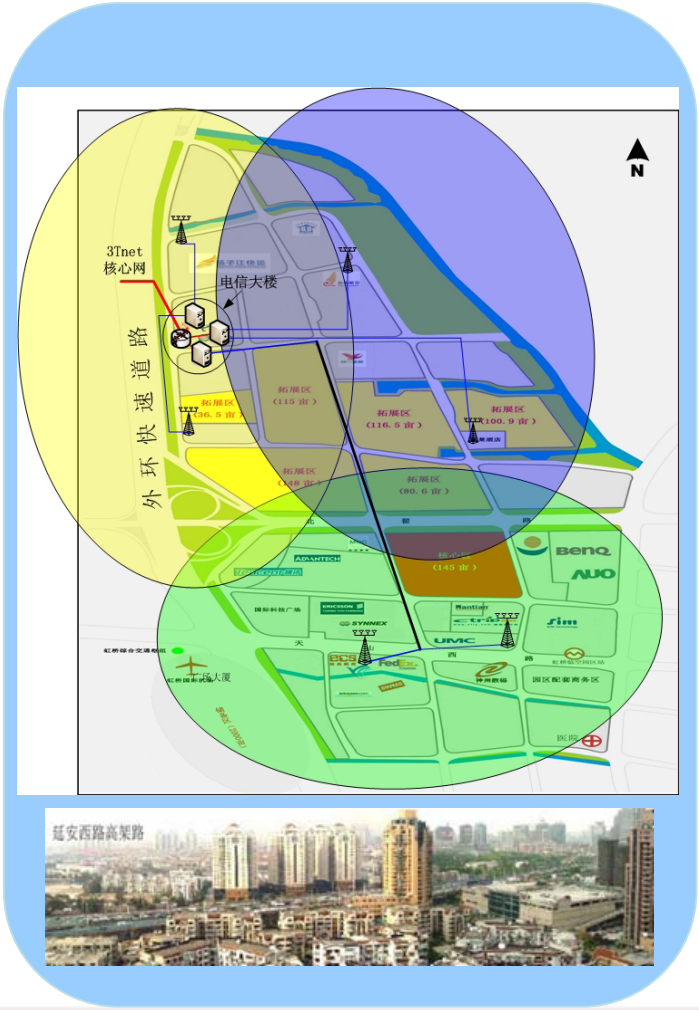
Software & Hardware Equipments

Control & Demo Platform

Outdoor Testing Environment

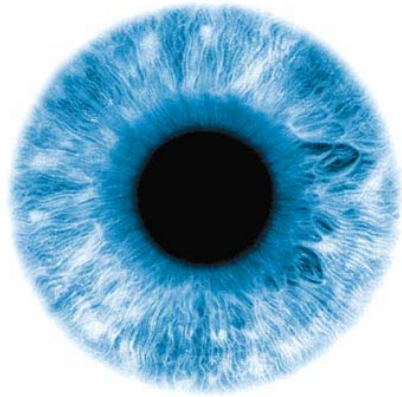
- Distributed MIMO wireless testing system
- 3 cells, 6-20 base stations
- Support both TDD and FDD systems
- Support urban, suburban, rural, and highway communication scenarios





Conclusions

- WiCO has strong research interests and expertise in 3G/4G mobile communication networks.
- WiCO has undertaken many R&D projects from the MOST, CAS, STCSM, and Telecom Industries.
- WiCO is keen to promote international R&D collaborations for knowledge creation, technology transfer and standardization.
- WiCO is a professional and fair player in generating and sharing IPRs.



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