

Successful Congress in Naples....next Wroclaw Poland.

Wroclaw FITCE 2015:

[Website and Call for Papers.](#)

Call for Papers Wroclaw 2015.

The Call for Papers for the Wroclaw Congress is already open.

The theme of FITCE 2015 is "ICT FOR SMART APPLICATIONS ". We require submission of technical papers and/or abstracts on topics related to this theme, but the Conference will cover all subject areas of interest both to the FITCE international community and to IEEE Communications Society members.

The main topics of the Congress are as follows, not excluding others:

- Reduction of Energy Consumption and Green Telecommunication
- Smart Metering and Intelligent Power Grids Solutions
- Support of Ageing Lives and Health Services
- Intelligent and Secure Transportation Services
- Electrical Vehicles and Supporting ICT Solutions
- Intelligent Buildings
- Internet of Things, Machine-to-Machine Applications.

Important dates are as follows,

- ▶Submission of abstracts, full papers or tutorials:
March 31, 2015
- ▶Notification of acceptance:
May 31, 2015
- ▶Submission of camera-ready:
June 20, 2015

More detailed information is available from the Congress Website and from page 5 of this Forum.



Report from Naples FITCE 2014.

FITCE 2014 in Naples was indeed a very successful Congress. There were 74 Delegates, 46 Speakers and 25 Partners in all. The location of the Congress in the Federico II University, in front of the bay of Naples, was an excellent choice and facilitated a learning environment which resulted in plenty of Networking between delegates.

The Theme of the 53d FITCE Congress "From network Infrastructures to Network Fabric: Revolution at the Edges", was a very up to date and relevant topic and attracted many high quality speakers. The Congress was also supported by the IEEE.



Congress Hall.

The Conference opened formally on Thursday 13th November, with the Welcome addresses.

Welcome Addresses.

The conference was formally opened in the Aula Magna of the University Federico II in view of the bay

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Message from Our President

Dear FITCE Members and Friends,

Three months have passed since our last meeting at FITCE Congress in beautiful city of Naples and it is now a good time to recall the main decisions taken during the meetings in Italy. Comité de Direction has recommended and the General Assembly of our delegates has decided to approve important changes to the formula and manner of FITCE operations. First, CD has to reconsider what is meant by FITCE brand for our Congresses. On the basis of valuable inputs provided by our colleagues from FITCE Italy and FITCE UK the proposal of a new characteristics of FITCE as "reliable (organization), responsive to the needs of its members and backed by a wealth of experience within the European ICT industry" is formulated. The discussion will be continued during next CD meeting in Warsaw, 27 of March, having in mind a European identity and perspective of the Federation.

The GA has approved a New Statutes and Voting Rights from 2015 onwards. According to the new rules a wider formulation of FITCE membership is approved, allowing all members of a FITCE National Association, if they can and want, to become effective or associate members of the FITCE Federation. This new formula will enter into force already, after translation into French and publication in Belgian gazette by the end of December 2014. We do consider this new membership possibility as a promising option for wider European identity and perspective for the members of our National Associations.



Wojciech Hałka
FITCE President

As a result of the new statutes the voting rights during GA were changed also, stating that the number of votes per NA is 2 and only Delegates have a right to vote. Each delegate may cast more than one vote, provided the number of votes assigned to the NA is not exceed.

Exceptional cases have been recognized of 1 vote per NA, if a discount, for maximum 2 years, is approved for a membership fee of this NA.

GA has confirmed that FITCE remains registered with the European Institutions and The European Internet Foundation (now on EI Forum) in order to maintain a dialogue with the Commission Services and the European Parliament members, specifically on ICT related aspects.

The CD has taken the decision to renew the agreement with IEEE ComSoc as a Sister Society relationship, which was first signed in September 2009 and already expired. During my working visit to Bruxelles, 20 of January, I've already signed this agreement. This new agreement will allow our members to receive access to some of technical publications of IEEE distributed on bilateral basis.

CD has proposed and GA has approved a new FITCE budget for 2015 needed for a lean organization. The budget is based on new license fee, fixed per each NA and drastically reduced net loss in 2015. This arises from the decisions to reduce the number of CD meetings per year, limiting travel expenses for Board members, cut-

ting of web site maintenance cost, etc. Important part of those savings is possible thanks to the FITCE Greece, which offered voluntarily to do web site maintenance and editing FITCE Forum at no cost. Let me here to send my warm thanks to Barry Reynolds for his job offered to FITCE during last years as our information manager and FITCE Forum editor.

The above decisions and actions were possible only because of the direct engagement with many colleagues, and as such, let me address my special thanks to FITCE Austria, Belgium, Italy and UK. Also many thanks to our Secretary General who reported to the GA his first year at this position, for his good job and supportive initiatives. GA has appointed also new Directors and deputies of the Executive Committee and the Board of Officers including SG, Treasurer and me, as a President for next tenure, which is for me a great honour, but also an obligation for more intensive involvement in our common FITCE matters.

I should address my special thanks to our Italian hosts, organizers of the 53rd Congress in Napoli and to the FITCE Italy for their excellent work done for the success of the Congress. We have got a number of very interesting papers presenting up to date network solutions and the technology of the edge. The Gala Dinner and social programme left us with many nice impressions and unforgettable memories of a gentle people and a beautiful city.

For 2015 Congress we are invited by Polish colleagues from FITCE Polska to the city of Wrocław, the capital of Lower Silesia region in Poland. The watchword of this year Congress is "ICT for Smart Applications" and we turn your attention to the topics like green telecommunication, smart metering and intelligent power grids, support of ageing lives and health services, intelligent and secure transportation, intelligent buildings, internet of things and M2M applications. We do expect a wide response to those subjects from ICT professionals, as the core components of all those applications are distributed systems and modern telecommunication networks.

For next year, FITCE Congress 2016, we all are invited already by FITCE Greece, to their capital and historic city of Athens.

Best regards to all of you and see you shortly in Wrocław and next year in Athens.

Wojciech Hałka
President of FITCE

(Continued from page 1)

of Naples. Present at the top table were Mr Nicola Maz-zocca - DIETI Director, Italy, Mr Wojciech Halka - FITCE President, Poland, Mr Andrea Penza - AICT President, Italy, Mr Ermanno Cardelli - IEEE Italy Section Chair, Italy, Mr Alessandro Luciano - FUB President, Italy, Mr Maurizio Mayer - EMTC 2014 General Chair, Italy and Mr Luigi Paura - EMTC 2014 TPC Chair, Italy

The FITCE President Wojciech Halka opened the Congress and mentioned the significance of the Euromed alliance. He outlined the theme of the Congress and the aims of FITCE, which keeps FITCE at the edge of leading technology.

Andrea Penza AICT president, opened by thanking all the many sponsors of the Congress and also outlined the History of AICT which is a year older than FITCE. He also dealt with the importance of the theme of the Congress at this time where Evolution at the edges is particularly important. He made special mention of the work done by M. Mayer and Luigi Paura in organising the Congress.

Maurizio Mayer the Congress Chairman, outlined the structure of the Congress and the exciting Partner programme.

Luigi Paura thanked all members of the Technical Programme Committee, for the effort in paper selection especially during the summer months. He outlined the topics of the congress. Received 64 proposals with 42 accepted each paper having 3 reviews.

Keynote Speech– Move to 5G Network Fabric.



Opening the Congress.

There then followed a keynote speech from Antonio Manzalini - Telecom Italia - IEEE SDN Steering Committee Chair entitled "From network infrastructure to 5G fabric:



Congress Hall.

The "Nervous System" for the Digital Society." 5G an evolution to a network fabric with server to server communication. Mentioned Open Compute Project launched by Facebook which will revolutionise the hardware at the centre of IT. with intelligence moving towards the edge with Users and smart things. 1/3 of traffic coming from Smart things by 2016 leading to 5G being the nervous system of the digital society and the digital economy. Enabling technologies are SDN and NFV. Any end terminal will look like nodes at the edge providing user services. Moving from electronics to software to cognition by robots and drones.

Round Table Discussion.

"Digital Agenda (DA) for the Mediterranean?"

There then followed a roundtable discussion with many speakers from Industry and the Universities on the Digital Agenda for the Mediterranean.

The Panel consisted of George Bafas - FITCE Greece, Luigi Gambardella - ETNO President Europe, Armando Chiari - ISCTI Director Italy, Wojciech Halka - FITCE President Poland, Kleio Kallimani - Greek Regulation Office, Vincenzo Lobianco - Networks Services Director AGCOM Italy, Salvatore Lombardo - CEO Infratel Italia Italy, Miguel Merino - FITCE Spain, Andrea Penza - AICT President, Italy, Luca Rea - FUB Italy.

The Moderator was Maurizio Mayer.

George Bafas mentioned that the most important project in Greece to cover the wide zones where there is low economic case, and will be supported by the public sector.

Armando Chiari - ISCTI Director indicated that the ISCTI is the R&D Institute for Italian Govt and is active in European framework programmes and worldwide standardisation bodies. It also offer high level education programmes to Universities.

Wojciech Halka - FITCE President outlined the Digital



Roundtable Discussion Panel.

Agenda in Poland. Effort is being focussed in backbone fibre optic network and by 2020 Broadband will be rolled out to most of the population using LTE. One interesting aspect is the common use of mobile infrastructure by Mobile Operator to allow efficient LTE access. There is a large database developed which logs the infrastructure footprint of 700 Operators.

Kleio Kallimani - Greek Regulation Office, indicated that despite difficult economic situation the Greek Government is prepared to rollout Wi-Fi to all areas, thus tackling the Digital Divide. The Greek Regulator is focussed on healthy competition on the Network.

Vincenzo Lobianco - Networks Services Director AGCOM, focussed on digital agenda in the EuroMed area, and

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**Looking to Wroclaw Poland.
FITCE 2015.
54th FITCE Congress.
"ICT FOR SMART APPLICATIONS".
3rd to 5th September 2015.**

The Conference.

Once again Polish Telecommunication Engineers Association (SIT Polska) are delighted to host you in our country during next 54th FITCE Congress in Wrocław, the capital of Lower Silesia Region. We've been honored already to host 46th and 51st FITCE Congresses in Warsaw and in Poznań, the watchword of that Congresses being dedicated to the actual problems of telecommunication development. This was the sign of our expectations of intense investments in new broadband technologies and of connecting new users and giving them new telecommunication services.

Nowadays we see new prospects for telecommunication services supporting new smart ICT applications.

For sure, electrical vehicles without drivers, distributed and intelligent power grids networks or many other new applications will not be possible without new telecommunication and ICT solutions. The 54th FITCE Congress will be a good reason to meet together and to sum up proposed new ICT and telecommunications technologies and make plans for future activities of our telecommunication society. We value very much this nice opportunity to host you during our 54th Congress of the Federation of Telecommunication Engineers Associations of the European Community.

Congress Timetable.

Thursday, September 3rd.

- 9:30 Opening Ceremony and Keynotes.
- 11:00 Panel Discussion on Smart ICT Applications
- 13:15 Technical Session 1
- 15:30 Technical Session 2
- 19:00 Welcome Reception

Friday, September 4

- 09:00 Panel Discussion on Telecom Developments in Poland
- 10:30 Technical Session 3
- 13:20 Technical Session 4
- 15:00 Tech. Session 5 & 6.
- 17:00 Closing session
- 20:00 Gala Dinner.

About Wrocław.

Wrocław is the fourth largest city in Poland and the largest one in the west of the country. City is inhabited by over 630 thousand of citizens.

As the largest city of the Lower Silesia, it is its administrative, economic and cultural capital. The history of the city is over a thousand years old, and the heritage of the past combines with the modernity of the business centre.

Multicultural, open to new ideas and challenges, the city is famous for its hospitality, and its cultural and scientific life fascinates and attracts. The unusual history of Wrocław, constantly enriched by prestigious scientific and cultural events guarantee that everyone who comes here will certainly see and experience something interesting, regardless of whether they spend several hours or several days here.

The centre of Wrocław is navigable on foot, but the city has an excellent public transport system for access to

FITCE2015 fee in EUR	Early payment Before May 31.2015	Late payment After May 31.2015
FITCE member	400,00	450,00
Non FITCE member	500,00	575,00
Student 1 day <small>excluding Gala Dinner</small>	50	60
Student 2 days <small>excluding Gala Dinner</small>	75	90
Companion	150,00	200,00
Gala Dinner extra invitation	65	75

Congress Fees 2015.

suburbs. Wrocław has many historical monuments. The Cathedral Island (Ostrow Tumski in Polish) is the oldest part of city. There are gothic St. John the Baptist Cathedral and the Holy Cross Church. There is also the Archdiocesan Museum – the oldest museum in Wrocław. You can find there the 13th century Henrykowska Book with the first sentence written in Polish. Inside the former seat of the city authorities – the Town Hall – there is the Museum of Townspeople's Art where you can see permanent and temporary exhibitions. Is also worth to see collections of the Museum of Medal Engraving Art in the Under the Golden Sun tenement.

About our University.

The mission of our University is to shape the creative and critical personalities of students and define the directions of development in science and technology. The education offered at our institution is strongly linked with scientific research and the needs of economy and is consistent with standards of the European Higher Education Area. The degrees awarded by Wrocław University of Technology are a symbol of high quality of education, confirmed by the National Accreditation Committee and the Accreditation Committee of Universities of Technology.

Today, it belongs to the best technical universities in Poland – over 34 000 students study here under the guidance of 2 000 academic teachers, at the 12 faculties, as well as in the 3 regional branches (Jelenia Góra, Legnica, Wałbrzych). It rates high in the annual rankings of Polish universities.

In this way, owing to the Wrocław University of Technology, Wrocław appears as the capital of Polish computer science. The high level of research carried out, matching the world's best, and the well-equipped laboratories result in a wide co-operation with Polish and international companies.

Finally, we would like to wish you all a very successful and pleasant stay in the city of Wrocław and hope that the Congress will prove to be interesting, stimulating and enjoyable both technically and socially.

With best wishes,



Wojciech Hałka
General Chair



Zbigniew Krawczyk
Organizing Committee Chair

Call for Papers.

54th FITCE INTERNATIONAL CONGRESS

September 2015, Wrocław, Poland



3rd-5th September 2015 : Conference Center, Wrocław University of Technology .

ICT FOR SMART APPLICATIONS

The 54th FITCE (Federation of Telecommunications Engineers of the European Community) Congress provides the international forum for the exchange of new results among engineers, scientists and researchers on advances in telecommunication and other related areas.



General Chair
Wojciech Halka
President of FITCE
and SIT

The Conference will be held in Wrocław, Poland on September 03th—05th, 2015r. Wrocław, Lower Silesian capital is one of the youngest in respect of the age of citizens in comparison with other cities and towns of Poland, and the city was distinguished by the significant percentage of youth and students. The theme of FITCE 2015 is "ICT FOR SMART APPLICATIONS ". We encourage submission of technical papers and/or abstracts especially on topics related to this theme, but the Conference will cover all

subject areas of interest both to the FITCE international community and to IEEE Communications Society members.

Papers will be peer-reviewed by the international TPC. When an abstract is accepted a paper is required for the proceedings and the paper should be presented at the conference in oral or poster sessions. The best paper will be selected for award.

Technical Program Chair:	George Agapiou FITCE Greece.
Publications Chair:	Ryszard Zieliński, Wrocław University of Technology Sławomir Hanczewski, Poznań University of Technology
Organising Comm Chair:	Zbigniew Krawczyk, FITCE Poland
Nat Organising Comm:	Mirosław Stando, Secretary General of SIT Małgorzata Porębska, SIT Wrocław
Organizers:	FITCE, Federation of Telecommunications Engineers of EU SIT, Polish Association of Telecommunications Engineers
Webmaster:	Maciej Sobieraj, Poznań University of Technology.
Information Contact:	Ewa Woroszyło, SIT Poland e-mail: zarzad@sit.org.pl
Conference website:	http://www.fitce2015.pl

ABSTRACT/PAPER SUBMISSIONS

We are expecting submission of high-quality abstracts and/or full papers (in English) reporting original results, research and implementations related to telecommunications deployment on power grid networks and innovative services on above topics. The TPC will review the abstracts/Full Papers on the criteria: innovative subject, fit for FITCE, clearness. Electronic submission is ONLY possible via the website <http://sit.org.pl> . Abstracts should contain name of author and affiliation and an indication of the area of interest as defined in this Call for Papers. Full papers should not exceed 6 pages, including all figures and references.

TUTORIAL SUBMISSIONS

Proposals are invited for tutorials (in English) on topics of interest of the conference. Proposals must be submitted to the Tutorials Chair (tutorials@www.fitce2015.pl) and include title, abstract, full contact information, introduction to the subject, length, past history, biography of the lecturer, and detailed outline.

IMPORTANT DATES

- ▶Submission of abstracts, full papers or tutorials:
March 31, 2015
- ▶Notification of acceptance:
May 31, 2015
- ▶Submission of camera-ready:
June 20, 2015

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hoped to extend this to the MENA (Middle East North Africa) area, in offering European best practices to these areas e.g. universal service provision and mobile number portability.

Miguel Merino - FITCE Spain, indicated that the Digital Agenda in Spain, is to develop by 2015 the digital goals of Europe comprising 32 different key indicators with all stakeholders.

Andrea Penza - AICT President, Italy, said that the Italian Govt is working hard to bridge the digital divide using ubiquitous and free Wi-Fi. It will guarantee free Wi-Fi access if the business footprint is greater than 100 sqm.

Luca Rea - FUB, Italy, said that the DA represents a great opportunity for emerging digital economies. Focus is to stimulate ICT to improve quality of life for the individual. Optic fibre rollout in 50% of network must be achieved in Italy. There is a need to redefine incumbents as service incumbents instead of only network incumbents. Also it must face question - is Copper Access the best solution to reach the population?.

Each speaker then presented their comments on what are the main priorities. This included sharing of information with Emerging economies, investment in access network, e-administration, upskilling of the general population to use the technologies, technical support for govt administration, Wi-Fi access as a public service, education of new generation for developing tools



Delegates Enjoying a break.

for tomorrow industry, greater speed of Govt response and Govt buy in, what should be free and what should not be free in terms of USP for broadband, and the building of digital competence in schools.

There then followed presentations on the areas of Mobile, Wireless and Satellite access and Smart Cities. One paper on Smart Cities between the UK and Italy is contained in this FITCE Forum.

Keynote Speech-ICT Applications for E-Commerce and Postal Services.

The Friday morning session started with a Keynote Speech by Kleio Kallimani, of the Greek Regulators Office. The presentation was on "ICT applications for e-commerce and Postal Services".

The total E Commerce turnover has risen to 350 Billion in 2013 from 200 Billion in 2009. The USA China and the UK account for 57% of total cross border e-commerce. The Presentation focussed mainly on the Postal Sector and changes here to take advantage of the e-Commerce era. One significant area is digital addressing. The UPU are tendering for a Europe wide addressing system. A few examples of digital addressing were given including one which will be operational in Ireland. Also explained was augmented reality using Google Glasses and facial recognition for parcel delivery. But at present there are technical limitations with the glasses and also significant cost barriers.

Keynote Speech-The Challenges in moving towards true Next Generation IP Networks.

The next Keynote speaker was Gianfranco Ciccarella of Telecom Italia. The spoke on Network Infrastructures and the challenges in moving towards a next genera-

tion all IP Network. The move towards all-IP network from a legacy silo network is not easy. The key thrust is an attempt to lower User Application throughput delay times, which has a significant impact on business effectiveness and bridging the digital divide. In many cases application throughput is 30-50% less than the connection bitrate. Telcos need to provide quality of experience (QoE) Platforms based on caching and protocol acceleration to improve Application throughput. A mix of QoE and moving L3 Nodes closer to the User is now an urgent necessity.

Keynote Speech-Smart Cities- a Reference Framework.

The next invited speaker was Dino Giuli of the University of Florence Italy. He made a presentation on "Smart City: a reference framework." He indicated that the Research and innovation for Smart City development is targeting the diffuse deployment and access of new basic smart systems and services, to enhance common human well-being in urban areas. The 4 main sectors targeted are (1) Basic and Infrastructural Utilities e.g. Transportation, Energy and Water, (2) Health, Safety and Security e.g. Territorial Security, (3) Private and public local living places and (4) Citizenship, social inclusion and education e.g. Welfare and Social Inclusion. Some of the challenges faced, are the inclusion of all ICT Stakeholders and the development of an ICT Evolutionary Framework for intelligent network peripherals.

The remainder of the Friday Sessions was taken up by more presentations on Network Infrastructures and Smart Cities. There were parallel sessions running during Friday Sessions.

The Congress was very well received by all the Delegates and great tribute is due to Maurizio Mayer and all his supporting team in putting together a Congress in such an attractive location and attracting speakers from many parts of the Telecoms Industry.

The FITCE General Assembly was held on Saturday 15th November.

A new Board of Officers was appointed for 2015 as follows,

- Chairman: Wojciech Halka (Poland)
- Vice Chairman: Zbigniew Krawczyk.(Poland)
- Secretary General : Walter Van Hemeledonck. (Belgium)
- Treasurer: Georges Devroey (Belgium).



Maurizio Mayer and part of his Congress Team.

Presentation from Congress.

The Business Requirements and Technical Fabric for the Smart City An Anglo-Italian View

Edward Smith, BT Group, United Kingdom. [Email](#)

Mauro Ugolini, Roma Tre University, Italy [Email](#)

Alessandro Neri, Roma Tre University, Italy, [Email](#)

I Overview: What Do We Mean By a Smart City

The evolution of communication networks, their architectures and the common protocols underpinning their design, when coupled with the economies of scale offered by Moore's law, give the opportunity of taking a fresh look at the development of public services, particularly those provided in urban areas. We will discuss how the available new technology can be blended to provide the "fabric" for a Smart City proposition and consider how such services can and are being developed. Six areas are widely considered to be important when assessing the effectiveness of a Smart City [1]:

- Regional competitiveness;
- Transport and ICT economics;
- Natural resources;
- Human and social capital;
- Quality of life;
- Participation of the citizen.

Often, political dependencies become a major factor in looking at how cities develop. These should be carefully balanced with critical social factors. Hence, we propose that the focus for such developments should be the users and return on investment in addition to their delivery and engineering.

In this paper we describe how the available new technologies can be blended to provide the "fabric" for a Smart City proposition and we analyse how new services based on these technologies can and are being developed.

Before giving some examples of Smart City projects in Italy and the UK, we will take a closer look, in section II, at the main technology enablers for Smart Cities that are available today.

II Smart City Technology Enablers

We believe that three capabilities come together to make the Smart City:

- the citizen's capability to exploit the infrastructure, often based around his own "IT readiness";
- the ability of the existing and planned civic infrastructure to adapt to the Smart City model;
- the superimposition of Smart City infrastructure on the fixed fabric of the city.

These should be used to drive increased local prosperity and competitiveness.

The proliferation of Wi-Fi and 3G/4G mobile networks, increased processing power, improved battery life and the availability of low cost sensors have combined to enable the development of the Smart City. The Personal Computer (PC) has been supplemented (and in some

cases replaced) by devices such as the netbook, the tablet PC, and the mobile phone. The smaller mobile devices have more computational power and much improved screen resolution.

An important ingredient has been a more computer literate set of users, who have developed a good understanding of the technology and its power of application, as well as having a high degree of trust.

Radio technologies too are playing an important role: they have ranges varying from a metre to over 18 billion kilometres so that they can be selected according to user requirements. In areas where people and structure density is high, and nomadic services are of primary interest, short range technologies such as Wi-Fi are effective; where longer transmission distances and effective mobility support are needed Television White Space or 4G mobile phone technologies (like LTE) may be more suitable.

Wi-Fi, in particular, is based on the IEEE 802.11 family of protocols and operates in the unlicensed 2.4 GHz part of the spectrum or the lightly licensed 5.8 GHz spectrum, with the former giving slightly better indoor reach. Due to their use of unlicensed spectral resources, most cities have deployed an extensive range of hot spots in their centres, at points of social interaction, offering free access to information and communication services.

Television White Space utilizes the vacant part of the UHF television spectrum (the "digital dividend"), released by broadcasters by virtue of the efficiency gains associated to the migration from analogue to digital video broadcasting. In more detail, with the DVB switch over, the spectrum in the range 606 to 790 MHz has become available for reuse for applications such as the Smart City [2]. We will give examples of this in section VI.

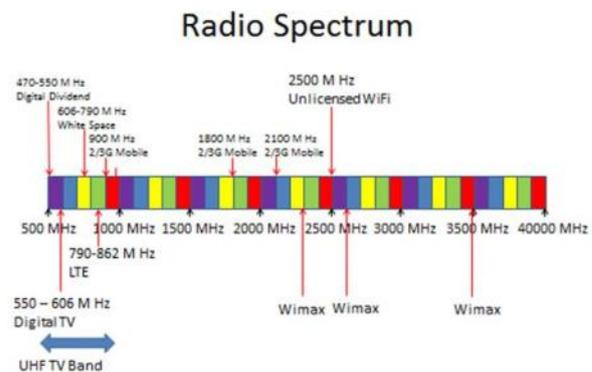


Figure 1: Radio spectrum alignment and ICT technology

The collection of sensor data for different applications may best be served by different architectures: for instance, where node mobility is important, MANETs (Mobile Ad hoc Networks) [3] can be used, whereas for applications like air pollution monitoring a static network topology is appropriate.

VANETs (Vehicular Ad hoc Networks) are an evolution of the MANET approach, tailored for communication among vehicles and between vehicles and roadside equipment.

Technical development accelerates as standards develop, since they provide a common framework, fuelling compatibility and interoperability and reducing time-to-market. Recent activity by the British Standard Institution (BSI) has led to the development of two new publicly available specifications. These define the vocabulary to provide a common way of talking about Smart Cities and a framework providing a guide to establishing strate-

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gies for Smart Cities and communities [4].

Having gained a better understanding of the main technology enablers for the fabric of the Smart City and an improved view of the role of technology standards in enabling these large, complex projects, we now focus on market development, analysed from a market research perspective first, then from an academic point of view. This analysis is presented in more detail in sections III and IV.

III Smart Cities: The Market Research View

A survey of market research literature reflects diverse views concerning the maturity of Smart City projects, but there is general acceptance that the concept is becoming increasingly important. The inherent complexity of a city means there is no common approach to delivering a Smart City. Brownfield implementations tend to be dictated by city structure, encouraging a silo approach to development; green field cities take a more top down approach, since the fabric is built with the structures in the new city.

The market for Smart Cities is assessed, globally, as being worth more than \$400 billion by 2020: the chief players are expected to be mobile and fixed telecommunications operators, systems integrators, Other Equipment Manufacturers (OEMs), service providers and IT vendors.

If we look at this global development scenario from a "regional" point of view, focusing on the situation of "sample" European countries like UK and Italy, for example, we find that interesting scenarios are starting to emerge.

The UK is expected to gain a 10% share (\$40 billion) of the total market value.

The UK government has established a Smart Cities Forum involving the government and representatives from cities, business, and scientists [5]. This investment includes £95 million of research funding by Research Councils UK, £50 million over 5 years allocated to the new Future Cities Catapult centre being established by the Technology Strategy Board in London, and £33 million invested in future city demonstrators. Other government-funded activities include projects to promote intelligent transport systems and smart ticketing, the roll out of telecare and telehealth in the National Health System (NHS), and the introduction of smart meters.

Italy is considered to be a leading exponent in Europe of the Smart City and like the UK has made a great deal of progress through partnerships between industry, municipalities and academia. For example, six major cities (i.e. Parma, Reggio Emilia, Bolzano, Salerno, Venezia and Nettuno) have recently agreed a common protocol on IT innovation with IBM. Under this initiative, joint committees between IBM and the different municipalities have been created, aimed at investigating how better serve citizens in specific areas like infomobility, safety, art and cultural exchanges [6].

A substantial investment program by MIUR, Italy's Ministry of Education, University and Research, has been recently launched, with the allocation through competition of a worth €305 million to a call for projects named "Smart Cities and Communities and Social Innovation". 32 industrial research projects covering interventions in areas from smart mobility to domotics and from cultural heritage to e-health, involving 399 private organizations and public research groups, have been funded. 48 social innovation projects originating from young researchers attract €25 million of the total budget [7].

A cross section of projects for both the UK and Italy will be provided in Section VI. However, further useful insights about the Smart City market development can be gained by integrating these findings with an analysis performed by adopting an "academic" perspective, as described in section IV.

IV Smart Cities: An Academic Research View

Academic research focuses on assessing the rationale behind the development of a Smart City and how this impacts the stakeholders involved in their development. In general such research observes that:

- the business case should be benefits driven and that the benefits, both tangible and intangible, should be clearly understood and articulated;
- in IT, rapid payback is increasingly expected, but a successful implementation of a Smart Cities initiative relies on the business case being assessed over a longer period;
- innovation is an ongoing process and this does not take place in a linear timeframe, therefore plans and architectures need additional flexibility, to accommodate new ideas as they evolve;
- there are a "wide spectrum" of stakeholders, whose views need to be taken into account, and particular attention needs to be paid to the requirements of the citizens who will derive benefit from the capability offered and will ultimately be the arbiters of value;
- the technical characteristics of these systems are radically different from traditional information systems, since they make use of tight control loops and are linked to and limited by the physical infrastructures that they interface to.

A fresh approach is needed in addressing this market; particularly, when considering the application of new technology products and new business models. This includes assessing a new project's potential for increasing the economic prosperity of a region. Social and environmental performance, as well as financial indicators need to be incorporated in benefits evaluation [8]. These ideas have parallels with the well-known hype cycle tool for assessing the introduction of new products and the balanced scorecard approach to measuring business success.

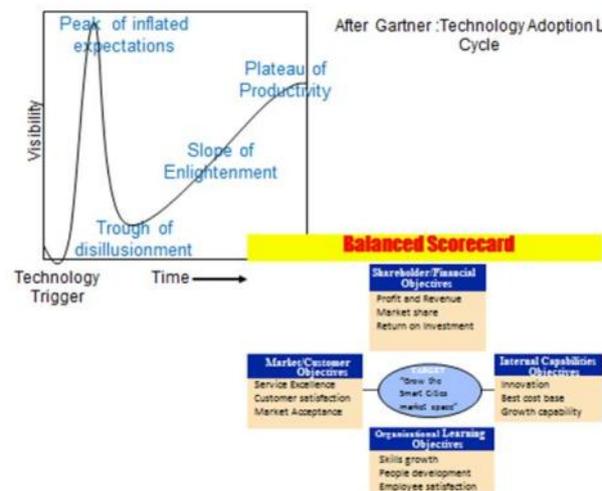


Figure 2: The Hype Cycle and Balanced Scorecard

It is imperative that the long term well-being of the citizen should not be sacrificed for the attainment of short term goals: alignment with long term objectives is vital [9]. To

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achieve this, we must move from shareholder to stakeholder value generation and prudent investment, and relating objectives to environmental and social benefits. Collaboration is key; this requires well-defined roles for the stakeholders and aligned goals that are carefully managed. A staged approach is postulated that moves through needs assessment, development actions and customer trials to a defined business model [10].

The Smart City is often identified as a more user centred evolution of similar intelligent city concepts [11]. This further supports the case for strong collaboration of stakeholders (industry, universities, public authorities and end users) and it is clear that citizen involvement is critical. Sensors and sensor networks are key enablers. EU programmes i2010 and Europe 2020 have highlighted the importance of Smart Cities.

Urban communities are also seen as territories with a high capacity for learning and innovation, the built-in creativity of their population, their institutions of knowledge creation and their digital infrastructure for communication and knowledge management [12]. Business-led urban development, linked with social inclusion and cast in terms of providing services to the citizens are important considerations. Three broad types of capability should be available: advanced producer services, physical transport and virtual networks.

Integration of information and control system technologies will be a further key driver for Smart Cities. Fabrics to consider include power, water and transport systems, which all require next generation infrastructures [13]. There are two viewpoints here: one is focus on a single infrastructure, e.g. transportation, the other is to try to achieve the total optimisation of city infrastructures. The first is found in developed countries and the latter in emerging countries, where there are more projects to build a whole city from scratch. Many technologies have commonalities across the two approaches: sensor networks, system optimisation through modelling, big data and integration of information and control systems. The integration of control and information systems is vital but these have very distinct characteristics as Table I shows.

Characteristic	Information system	Control system
Response	hard real-time	best effort
Recovery	rollback	sense & restart
Lifecycle	3-10 years	10+ years
Resource	rich, virtualized	limited, real
Architecture	open, standard	closed, proprietary

Table I: Main characteristics of control / information systems

Technical integration of the control and information systems is therefore likely to be technically complex and require a staged approach to planning. We will discuss this further in sections V and VI, while giving a closer look to some interesting project experiences in the Smart City developments of two significant national contexts.

V Early Smart City Projects

The conversion of these ideas into practical projects will be examined by first considering a selection of pathfinder projects, often starting with a single technology with multiple applications; we will then look in more detail at some illustrative examples of modern implementations based on the experience in the UK and Italy.

In 2000 BT delivered a project for Bracknell Forest

Council, which used a contactless "Edge" smart card to allow citizens to pay for services obtained from the council. This included use with attendance management at schools, providing an e-cash capability for the finance department, support for library administration, application to leisure activities (the borough Skate Park initiative) and payment for car parks. The project involved evaluation of technology, working with suppliers to build prototypes, developing processes for card management and providing the required service wrap.

A clear example of a silo implementation is London's Oyster card, which is a prepaid card used on the underground system and which is being introduced on London buses using 3G wireless capability on the fleet of about 8,500 buses. It is not however accepted by the London bike rental scheme.

Since 1999, Helsinki has been a major investor in city wide IT services [14]. This was enabled by high mobile phone density and strong uptake of the Internet. Key projects enabled traffic signal prioritisation and real-time passenger information, on-line journey planning, mobile ticketing using SMS, fleet management for buses and trams and real-time information displays. Vehicles are located by a combination of GPS, door opening and closing signals and odometer readings. Traffic signals are activated by a low power arrival radio signal from the vehicle to roadside equipment. These long serving systems deliver benefits to passengers due to reduced journey times and operator cost savings.

From these early implementations, significant progress has been made in Smart City developments; Section VI describes some interesting examples, with reference to UK and Italy.

The Smart Cities in the UK and Italy

A more general development of ideas in the UK is summarized in Table II.

Smart City Topic	Project
Public Transport	London, Southampton
Ticketing	Milton Keynes
Passenger information systems	Glasgow
Parking space management and payment	Birmingham, Milton Keynes
Congestion charging	London
Traffic volume monitoring	Birmingham, Manchester, Glasgow, Milton Keynes
Traffic lights and enforcement cameras	
Public safety	Birmingham, Glasgow
Environmental	Birmingham, Milton Keynes
Tourist information services	
Health monitoring	Glasgow

Table II: Cross section Smart City projects / topics in the UK

Around 20 organisations will be participating in Ofcom's pilot of use of white space spectrum, with projects ranging from sensors that monitor the behaviour of cities, to dynamic information for road users and rural broadband in hard to reach places. This spectrum will be available on a license-exempt basis, potentially allowing for fast take-up and innovation by manufacturers [15].

Sensors in cars and on the roads, on a 50-mile stretch of the road linking Birmingham and Felixstowe, monitor the build-up of congestion by transmitting data to a central traffic control system using White Space radio access. This

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will smooth traffic flow by setting variable speed limits based on analysis of the information received. Radio access will be achieved using base stations attached to street lamps or BT exchanges [16, 17]. Ofcom anticipates that White Space technology could be fully rolled out later in 2014, enabling its use across the country [15].

Glasgow is providing free Wi-Fi using an 80 node, network-based, white space spectrum [18]. This technology will also be used to link a network of sensors around the city. Glasgow has won £24 million funding through the Technology Strategy Board to develop a future cities demonstrator, to show the impact of new integrated services across health, transport, energy and public safety. Applications in areas like fuel poverty, health issues, service provision, building energy efficiency, crime prevention, anti-social behaviour and travel infrastructure, are being considered [18].

Birmingham is working with leading community experts, universities and ICT companies, to deliver projects to provide a 60% reduction in emissions by 2026. A city-wide Wi-Fi network will allow town planners to manage traffic, with more than 500 traffic related sensors covering signal junctions, traffic signs, car parks and CCTV, all linked to a single control room. Parking sensors, giving motorists real time data on the availability of on-street parking, are also being trialled [19].

Projects in Milton Keynes will centre on a Data Hub, which will acquire data from infrastructure networks such as energy, transport and water and other relevant sensor networks including weather and pollution data. New solutions for managing demand can thus be developed, delivering an anticipated 20% water savings, 50% less traffic congestion, a 2.8% reduction in electricity consumption and a 2% reduction in gas consumption [20]. Other key enablers are: a core fibre optic network, smart card technology, a real time information network, a city wide sensor network, applications that promote social interaction, consumer high-speed, fibre-based broadband and 4G mobile internet access, satellite data and investment in low carbon energy infrastructures.

There are plans to use sensors to determine when rubbish bins are full and when parking spaces are empty [21]. A city wide trial of these technologies will start in September 2014 and will be centred on 15 base stations that will be connected to the internet and can collect signals from thousands of objects.

The city has created a value framework, based on a two dimensional matrix drawn up on a per project basis, to show the benefits and outcomes of each programme. The horizontal axis considers innovation, the response to change and the outcome, whilst the vertical axis looks at the city systems integration required for sustainability [22].

In Italy, a cross section of projects, which follow the same key topics as seen in the UK and elsewhere, is shown in table III.

Modelling, based on the traffic conditions for Rome, has shown that mixing static road side units (RSUs), working with on-board devices to a form a Vehicular Ad hoc Network (VANET), can improve flows when traffic densities are low [23]. Practical projects are underway in Salerno, to create an urban traffic monitoring and control system, using technology components already available, in traffic lights, limited-access streets and surveillance cameras. This will include traffic flow analysis and parking assistance [24, 25]. A pilot of a sensor-based

parking management system is also underway in Pisa, which is likely to be extended to analyse traffic data to optimise the flow of traffic [26]. Padova is working on similar transport based initiatives [27].

<i>Smart City Topic</i>	<i>Project</i>
Public Transport	
Ticketing	
Passenger information systems	
Parking space management and payment	Pisa, Salerno
Congestion charging	
Traffic volume monitoring	Roma, Pisa, Padova
Traffic lights and enforcement cameras	Salerno
Public safety	Salerno, Padova
Environmental	Bari, Padova, Genova
Tourist information services	Salerno
Health monitoring	Salerno

Table III: Cross section Smart City projects / topics in Italy

A range of public safety applications, such as smart lighting and automation, are also being considered [27]. Salerno has initiated a project to use smart sensors within planking and smart canes to provide guidance to the blind coming from a dedicated parking area to the city's Verdi Theatre. Information and prompts will be provided on mobile phones, enabling the visually impaired to navigate around obstacles [24, 25].

There is also a wide range of environment and energy projects: for example Padova is working with structural health, waste management, air quality management, noise monitoring, and city energy consumption [27]. Bari [28] is participating in EU initiatives to reduce CO2 emissions and improve the quality of life through the monitoring and management of energy systems. Utility operators and the municipality have partnered to develop a data acquisition and processing platform that allows the monitoring of energy consumption following the transition to the Smart Grid. Genova has set an ambitious target for greenhouse gas emission reduction of between 20% and 50% by 2020 [29]. They will focus on four major areas: efficient buildings, road, sea and rail transport, direct energy issues and improving the energy efficiency of its harbour.

The interest in energy conservation can be traced back to 2001, when ENEL (the public company in Italy for production / distribution of energy) drew up a five year plan to address the energy consumption of the 40 million premises it serves [30]. Savings come from automatic collection of customer data and remote management of the energy network.

Salerno offers a tourist information capability using two-dimensional tags to highlight the city's cultural and artistic heritage, providing visitors with information through their mobile phones as they explore the areas served. The city is also working on a distance health monitoring capability for the elderly. Another health initiative comes from Padova, who have developed a service specification to control environment and salubrity within buildings [27].

Other applications are of course being considered: Parma for instance is looking at the installation of virtual tellers in several locations around the city, allowing citizens to carry out municipal interactions such as delivering and receiving

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documents and cheques, filling in and signing forms, and requesting support [31].

VII Conclusion

We have looked at the evolution of Smart Cities through combining views of: the underlining technologies, market research and academic perspective on the market, assessment of the early applications and the current evolution of implementation in the UK and Italy. Revolution at the edges has been at the forefront of our minds, as we have discussed the objectives for developing a Smart City, particularly the link between the business/requirements model and delivery of the key concepts through applications, sensors and edge networks. Whilst technology is a vital enabler, we have made it clear that the market will determine how the facility will be exploited. We are convinced that these initiatives need to take a long term view of the returns and be developed through well integrated partnerships; measuring the benefits with particular emphasis on the role citizen as a key stakeholder and arbiter of value.

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