IEEE Future Directions
New Initiatives

- Internet of Things
- Transportation Electrification
- Smart Cities
- Cloud Computing
- Big Data
- Rebooting Computing
- Software Defined Networks
- Green ICT
- CyberSecurity
FDC Scope

Anticipate and Determine the Direction of Existing, New and Emerging Technologies, and Related Issues, and Spearhead their Investigation and Development by IEEE

Technologies:
- Cloud Computing
- Green ICT
- Internet of Things
- Software Defined Networks
- Rebooting Computing
- Transportation Electrification
- CyberSecurity
- Big Data

LV⁴: Leveraging Data Volume, Velocity, Variety to create Value

World Challenge:
- “Growing Urbanization: Smart Cities”

Act as Facilitator in Creating a New TAB Technical Community

- Help develop Business Plan for Technical Community and forward to TAB Management Committee
Emerging Technology Maturity Model

- Ideation
- Incubation
- Launch
- Steady State

OU: Organizational Unit
FD: Future Directions
NIC: New Initiative Committee
FDC Maturity Model

Where we are today?

BD SDN RC

GICT CbS COMSOC CS

Incubation

Phase 1: Coordinate across IEEE OUs
Phase 2: Position as “One Face” to Customers
Phase 3: Position as “Thought Leader”

Operationalize

NBaU: Not Biz as Usual
# FDC Incubator Project Metrics

<table>
<thead>
<tr>
<th>Technology</th>
<th>Web Portal</th>
<th>Tech Community*</th>
<th>SME Lead(s)</th>
<th>New or Existing IEEE Standards Inclusion</th>
<th>IEEE Steering Committee</th>
<th>IEEE Event</th>
<th>2014 FDC Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC</td>
<td>Yes</td>
<td>Yes 738 members</td>
<td>E.Track T.Conte</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GICT</td>
<td>No</td>
<td>Yes 2,305 members</td>
<td>J.Elmirghani</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>SDN</td>
<td>Yes</td>
<td>Yes 1,107 members</td>
<td>A.Manzalini</td>
<td>No</td>
<td>Identified</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>CbS</td>
<td>No</td>
<td>No</td>
<td>G. McGraw C. Landwehr</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* As of 19 June 2014

**LV⁴: Value increase**
IEEE Technology Time Machine
TTM 2014
ttm.ieee.org

A Tool FDC uses to look at New Space

Symposium Tracks

A Future of Humans [SSIT]
B Future of Health Care [EMBS]
C Future of Fabrication [RAS]
D Future of Processing [CS]
E Future of Energy [PES]
F Future of Networks [ComSoc]

Venue:
– 21-22 October 2014, Dolce Hayes Mansion, San Jose, CA
Smart Cities Wheelhouse

- Leverage $LV^4$

- Smart Cities:
  - Utilizing: Internet of Things, Big Data, Transportation, Green ICT, Rebooting Computing
# Societies Proposals: FDC-TAB Incubator Projects

<table>
<thead>
<tr>
<th>Society</th>
<th>Topic</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>CES</td>
<td>Safe Advanced Mobile Power</td>
<td>Approved</td>
</tr>
<tr>
<td>PES</td>
<td>INTELECT Conf and Expo</td>
<td>Approved</td>
</tr>
<tr>
<td>RS</td>
<td>Tutorial Certificate Program on Sw Reliability</td>
<td>Approved</td>
</tr>
<tr>
<td>CS</td>
<td>Advanced Best Practices Learning Pack</td>
<td>Approved</td>
</tr>
<tr>
<td>ComSoc</td>
<td>Two-day continuing education courses</td>
<td>Approved</td>
</tr>
<tr>
<td>ComSoc</td>
<td>Rapid Reaction Standardization Activity for Internet of Things (IoT)</td>
<td>Move to IoT Initiative</td>
</tr>
</tbody>
</table>
FDC 2015: Top Technology Contenders

- 3D Printing
- Brain Machine Interface
- Smart Materials
- Cross Cutting
  - Environmental
  - Trusted Cyber Space
Become Involved

fdc@ieee.org

The IEEE Future Directions Alphabet Soup
- BD
- CbS
- CC
- GICT
- IOT
- RC
- SC
- SDN
- TE

Needs you to become involved as an Expert to make a difference
- You: Sections, Chapters, Societies, Councils. Everyone
- For Smart Cities: Requirement is for a local Section and/or Chapter manage the day to day activities.
FDC Maturity Model: Incubation Phase

- Incubator managed and funded by TAB Through FD
- Milestones to move from Incubation to Phase 1
  - Web Portal Launch, Staff and Volunteer content curation
  - IEEE New Technical Community formation: 500 members
  - Minimum of 1 S/C partner
  - Vetted Initiative SME who will lead the technology from Incubation to launch
  - Successful delivery of one unique or collaborative event
  - Formation of an IEEE wide Steering Committee
  - A Checkpoint involving new or emergent IEEE Standards activities
  - Continued support of FDC in this topical area
- Phase 1 to Launch Requirement:
  - IEEE funding through NIC and subsequent BOD approval
  - Initiative grows from TAB to IEEE wide
  - May require STDS, EAB, MGA, M&S, Corporate Comm. Involvement
  - Metrics are a function of the specific project plan, however community growth is a fundamental metric for each initiative
Things to consider in each Phase

**Incubator**
- Bleeding Edge
- New to IEEE
- New for Coordination
- New Tools

**Phase 1: Coordinate across IEEE OUs**
- Content, scope
- Global Perspective
- Prods: Conf, Stds, Educ, New Oppt, Community Building
- Gap Analysis
- Id lead OU(s)

**Phase 2: Position as “One Face” to Customers**
- One voice
- Customer Impact
- Member Impact
- Portal
- Connections are seamless
- Pipeline from “Contributors” well developed
- Branding
- Social Media

**Phase 3: Position as “Thought Leader”**
- Drive Leadership
- Right People on the bus
- Public Visibility oppts
- Gov/industry interest
- Positioning of Key Stds
- Metrics: Inc. Paper submissions, usage stats, web hits, Advertising $

**Ongoing Support**
- Operationalize
- Sustained income
- Long term goals
- Final structural option: Lead OU stabilization or new committee development
• Issues are identified at each stage that create the need for more focused research or development.
• Customers are different at each stage
Technology Coverage Model: Assuring full coverage across lifecycle

- New options
- New technologies
- Optimization Algorithms
- Improved efficiency
- Reliability
- Quality
- Standards
- Reliability
- Quality
- Standards
- Network Mgmt.
- Ops Mgmt.
- Data Mgmt.
- Policy
- Recovery of materials before disposal
The activities funded by the Initiative fill gaps in coverage, provide a “One IEEE” view and support the efforts of the individual OUs. They serve as the foundation to help build Thought Leadership -- the “glue” that ties it all together.

### Smart Grid Product/Service Ecosystem

- **Web Portal**
  - Content Update
  - “Opt-In” Group
  - Search Engine Optimization

- **Newsletter**
  - Editorial Support
  - Staff Support
  - Article Pipeline
  - Subscriptions

- **Conferences**
  - Smart Grid World Forum
    - 2010 - Brussels
  - 2011 – China
  - 2012 – Geneva

- **Marketing/Communications/PR**
  - Branding
  - Logo
  - Press Releases
  - Interviews
  - Placed By-lines
  - Supported Media Events

- **SG Technical Community**
  - Subscriptions
  - Thought Leader Roundtables
  - Whitepapers w/surveys
  - Webinars
  - Ask Me Anything (AMA)

- **Social Media**
  - IEEE Smart Grid LinkedIn Group
  - IEEE SG Twitter site
  - YouTube
  - Wikipedia

- **Publications**
  - Transactions on Smart Grid
  - Transactions On Sustainable Energy
  - Journal of Photovoltaics

- **Articles**
  - 8,500+ in Xplore

- **SG-Specific Conferences**
  - ISGT
  - SmartGrid Comm
  - Smart Measurements for Future Grids

- **Conferences with Smart Grid Content**
  - IEEE PES T&D
  - IEEE Power Line Communications
  - Applied Measurements for Power Systems

- **Standards**
  - IEEE 2030
  - IEEE 1547.4
  - IEEE 1701, 1702
  - IEEE 1901
  - 90+ additional SG-related

- **Continuing Education**
  - Smart Grid Boot Camp
Smart Cities Initiative
A Response to the Urbanization Challenge

Gilles Betis
Trend Toward Smart Cities

- Half of the world population is living in cities in 2013
- Half of the population of Asia will be living in cities by 2020
- Half of the population of Africa will be living in cities by 2035
- Population in cities is expected to grow from 3.6 Billion to 6.3 Billion by 2050
- Megacities are impressive but represent only 9.9% (13.6% in 2025). Over 50% of urbanization involves cities of less that 500K people
Growing Urbanization

http://esa.un.org/unup/Maps/maps_urban_2025.htm
Growing Urbanization


http://esa.un.org/unup/Maps/maps_urban_2025.htm

**Percentage of urban population and agglomerations by size class**
Urban challenges
at least some of them...

Housing

Traffic

Pollution

Water & Energy

Health & Wellbeing

Crime
Citizenship & Democracy

- Vote
- Hacktivism
- Demonstrations
- Associations
- Riots
- Participation
The Emergent Economy

collaborative & open

Shared Cars

Collaboration

Peer-to-peer

Crowdfunding

Open Currency

Swap
A matter of transition

- Behaviour
- Governance
- Business
Cardinal Objectives of Smart Cities

SMART?

Attractive for People & Business

Inclusive

Sustainable

Silent

Agile & Adaptive

Support Stable & Robust Process

Is it just a matter of TECHNOLOGY?

Creating societal value for the urban ecosystem
Value chains in the ecosystem
The IEEE Smart Cities Initiative is a global, multi-disciplinary, cross-OU effort to:

- Create a vibrant and world wide network of cities, providing education, insights and expertise
- Collaborate to share knowledge, experience and good practices
- Involve local governance, universities, industries and local IEEE volunteers
- Assist municipalities in managing the transition to urbanization
- Raise awareness of the benefits and downsides of technology and help guide the appropriate uses of technology
- Establish IEEE as a thought leader and trusted source for information on technology related to Smart Cities
- Associate with ITU and Marshal McLuhan Foundation
The Initiative Galaxy

The Smart Cities Initiative Network & Forum

IEEE Affiliated Cities

Guadalajara
Trento
City #4
City #7
City #5
City #8
City #6
City #9
City #10
Wuxi

Selected Cities

Good Practices
Knowledge
MOOCs
White Papers
Conferences
Deliverables

As a framework for the initiative
- Web Portal
- Knowledge Database: Whitepapers, applications, metrics, use cases, etc.
- On-Line Technical Community
- Dissemination through press releases, newsletter, conferences, Twitter feed...

For each of the selected cities
- Completion of one quick-off workshop per city
- Working groups and whitepapers
- Metrics to measure effectiveness of municipality efforts to evolve to Smart City
- Published theses and doctoral dissertations from university students in each city
- Four MOOCs per city developed by the selected universities
- Courses developed by the universities on jointly agreed upon topics
- Follow-on conferences
- IEEE have rights to use courses and publications outside the country where developed
Activity Flow and Deliverables

Kick-Off Workshop → Working Groups & White Papers → MOOCS

MOOCS → Masters & PhD → IEEE International Conferences

24 months

Web Portal – Data Repository – Metrics

Press Release – Newsletter – Twitter Feed – Conferences
Organization

- FDC Director: William Tonti
- Program Director: Harold Tepper
- Chair: Gilles Betis
- Champion: Roberto Saracco

Initiative Steering Committee:
- S. Bregni
- G. Giannattasio
- Y. Ghamri-Doudane
- Y. Wang
- R. Rossetti
- D. A. Grier

2013:
- Pilot City: Guadalajara
  - Section Chair: R. Barrera-Michel
    - CCD: V. Larios Rosillo
      - U-GDL: G. Gomez Araceli

2014:
- 2nd Batch City: Wuxi
- 2nd Batch City: Trento

2015+:
- Xth Batch City: Xxxxx

Partners:
- ITU
- Marshal McLuhan Foundation

IEEE Smart Cities
Context of GDL City

Facts
- Founded in 1539
- 4.2 Millions People
- x4 growth in past 30 years
- 6 interconnected municipalities
- 17Km from north to south
- 1/4 of Mexico City Size
GDL City evolution

Morelos Park in Downtown

Downtown social tissue reconstruction

City renewal keeping traditions, architecture and talent designed by MIT Carlo Ratti

Selected city from a national contest to be the smart city model for Mexico
The renewal project

- 40 hectares @ digital hub + 380 hectares of sustainable impact
- Capacity for talent production & attraction
- IEEE Volunteers with compromise
- High tech industry ecosystem supporting

http://ccdguadalajara.com
GDL CCD Project Video

https://www.youtube.com/watch?v=5UDWfU_wDq0
IEEE Smart Cities Pilot in GDL

- MOU IEEE- GDL City July 2013
- Kickoff workshop in GDL October 2013
- IEEE Volunteers in Working Groups
GDL volunteers organization

IEEE Smart Cities Working Groups

- PHI - Physical Infrastructure
- IOT - Internet of Things
- EDU - Education for Smart Cities
- ODF - Open Data Framework
- MTX - Metrics for Smart Cities
- DAV - Data Analytics and Visualization

6 WG
60 volunteers
GDL 1st Results & Opportunities

Whitepapers to share the experience & Knowledge
GDL 1st Results & Opportunities

New Smart Cities MOOCs Development in process

New Smart Cities Innovation Center at Universidad de Guadalajara

New Living Labs Projects for the City and a Smart Territory

New IEEE Smart Cities workshop in WCIT 2014 @ GDL
Lessons learned at GDL Pilot

- **Working groups**
  - **Commitment** of volunteers takes time (Stamina addicted kernel supporting)
  - **IEEE Kickoff** necessary to create out of the box initiatives & create confidence
  - **Neutrality** of IEEE important for the ecosystem (academy, government, industry)

- **City Impact with IEEE**
  - Not to **reinvent the wheel** and share with other cities -> Opportunity
  - IEEE as facilitator towards an **inclusive & collaborative Smart City**
Smart cities
Engaging technologies and communities

Ir. Guy Vekemans
• Smart cities in Europe, what’s happening?

• Some examples of large scale pilot projects

• Bringing smart cities technologies and concepts to the market – KIC InnoEnergy
The energy “revolution”

Flexibility as “key feature” of the future energy system

Future decarbonised energy system needs all flexibility solutions:

- Energy storage
- Energy cluster management incl. flexible demand response
- “Dispatchable” power plants
- Interconnection with adjacent markets
It’s all about efficient integration

I was on my smart phone in my smart car and I smashed into my smart home.
<table>
<thead>
<tr>
<th>Customer Readiness Level</th>
<th>TRL 1-3 basic observations &amp; concepts</th>
<th>TRL 4-5 R&amp;D phase, laboratory development</th>
<th>TRL 6-7 pilot or type test validation</th>
<th>TRL 8-9 1st commercial project in operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRL 4</td>
<td>many customers would buy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRL 3</td>
<td>at least one customer would buy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRL 2</td>
<td>need within 1-5 yrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRL 1</td>
<td>future &gt; 5 yrs need</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Technology Readiness Level**

**Market**

- **KICs**
- **EU smart cities and communities initiative**
- **covenant of mayors**

**Integration on EU level**
Smart cities communities initiative (EU)

Smart Cities and Communities Initiative
Launch Conference

Brussels, 21 June 2011

http://www.eu-smartcities.eu/
European energy research alliance

www.eera-set.eu

Coordinating energy research for a low Carbon Europe

http://www.eera-sc.eu/
Urban Europe

Strategic Research Agenda - Process

4 pillars representing challenges

- Society
  - Ageing Segregation

- Economy
  - Brain drain Stagnation

- Mobility
  - Congestion Emission

- Ecology
  - Climate change Degradation

4 integrated city images representing research demands

- Entrepreneurial City 2050
  - (1) Human and Economic Capital
  - (2) Technology and Logistics Capital
  - (3) Environmental Capital
- Connected City 2050
- Liveable City 2050
- Pioneer City 2050

http://www.jpi-urbaneurope.eu/
KIC InnoEnergy

Bringing research to the market

CC BENELUX
- Intelligent energy-efficient buildings and cities

CC IBERIA
- Renewables (wind, CSR, solar, wave and tidal energy)

CC ALPS VALLEYS
- Sustainable nuclear & renewable energy convergence

CC SWEDEN
- European Smart Electric Grid and Electric Storage

CC POLAND PLUS
- Clean Coal Technologies

CC GERMANY
- Energy from chemical fuels
Examples of large scale pilot projects

Glasgow
Göteborg
Riga
Ghent

Leuven
Bergamo
Freiburg
Houthaven

Aberdeen
Malmö
Hamburg
Zaanstad – A’dam
Antwerp

Amsterdam
Grenoble
From Sustainable energy action plans to district projects

http://www.stepupsmartcities.eu
Linking competences
Linking money

Stakeholder Board

Public and private investors

Overarching Investment Trust

Project 1 (eg District Heating)

Project 2 (eg Waste to Energy)

Project 3 (eg Biomass)

Controls wider strategy; Plans; Monitors impacts and opportunities; Revises strategy; develops relationships; builds support; ensures projects match public policy objectives; maintains joined up approach; integrates strategy into public policy and wider plans.

Raises funding; develops relationships with potential investors; assesses projects for investment by:
- assessing match to public policy goals and overall framework
- financial viability
- matching projects with investor priorities

Implements and operates new low carbon energy systems and infrastructure to deliver carbon reductions and economic regeneration. Range of potential business models – public private partnerships; publicly owned; commercial or community ownership.
Linking partners

Creating a Partnership

Source Richard Bellingham, Univ. Of Strathclyde
Energy Hub

- Multi commodity control
- Combined heat/electricity storage
- Innovative thermal storage:
  - State of charge
  - Thermochemical storage
  - Combination short/long term

http://www.e-hub.org/
E-harbours
City-Zen

District Nieuw
West Amsterdam

District Ecocité
Grenoble

KIC InnoEnergy bringing research to the market

Owned by 27 leading industries, research centers and universities of the European energy market; 6 operating centers

About KIC InnoEnergy

- The European company for innovation, business creation and education in sustainable energy,
- Provides integrated solutions for finalizing and commercialization of technologically innovations, leading to new products and services at lower costs and higher market success,
- Core expertise in supplying know-how, infrastructure, proven processes and market access through its partner network, in managing and funding of collaboration in international consortia, in educating technological competent, entrepreneurial talents (the “game changers”) and in nurturing of start-ups, small enterprises and spin-offs,
- European wide risk-sharing partner, acting as investor, utilizing financial resources from EIT and owners

Facts & Figures (2013)

- Over 150 active Partners in KIC InnoEnergy, thereof 111 from Industry
- Business volume over 200 Mio €, over 40 Mio € for new investments
EnergyVille – a key player
Engineers have a key role in smart cities projects

– as part of the designer teams
– to adapt technologies from TRL 6 to 7-8 taking into account:
  ▪ Customer behaviour – participation
  ▪ Scale effects
  ▪ Interoperability issues
  ▪ Cross disciplinarity
– as entrepreneurs e.g. ESCO’s on DSR, retrofit,...
QUESTIONS