



# Informatics Education as a Driver for Country Development



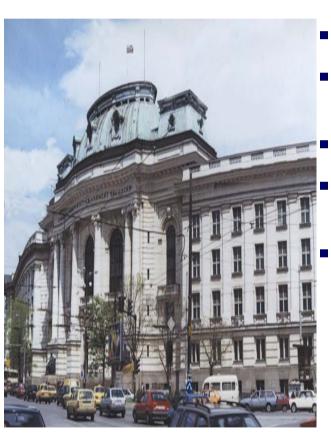
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#### Outline

- Sofia University and Faculty of Mathematics & Informatics
- European Dimensions of Informatics Education
- Implementing ACM/IEEE Computing Curricula
- Informatics Education Dynamics
- The Role of New Member States in Europe of Knowledge
- Education and Research as a Meta-industry and driver for country development





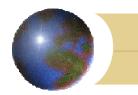
- 17 Faculties
- 35 000 students and over 3 000 teachers & researchers
- 80 Bachelor's and over 200 Master's programmes
- Very important role for the development of the country
- Challenges:
  - to become a National and Regional High-Technology and Innovation Centre, an entrepreneurial university
  - to adopt new standards and models of education
  - to implement the new role of universities as an infrastructure of Knowledge Economy
  - to build a sustainable university-industry-government partnership



#### Faculty of Mathematics & Informatics

#### Curricula re-design at BSc, MSc and PhD level:

- Implementing ACM/IEEE CC2001/CC2005 BSc in CS, SE, IS
- Participation in Intel Multi-core Curriculum Program (Top Tier University Club)
- MSc Programs in: Artificial Intelligence; Computational Science and Engineering, Computer Graphics, eBusiness and eGovernment, eLearning, Bio-Medical Informatics, Information Systems, Mobile Technologies and Distributed Systems, Software Engineering, Information Security, Computer Graphics, Mechatronics and Robotics
- PhD program linked to EC IST RTD priorities



#### Centre of IST, Sofia University

- Large international partners' network in Europe (more than 600) and in Bulgaria (more than 300)
- Strong links with ICT industry: Intel, Cisco, HP, Oracle, MS, SAP, SMEs
- More than 50 projects related to the European Space of Higher Education (FP4, FP5, FP6, FP7, Tempus, Leonardo, Phare, etc.)
- Several projects in innovation and technology transfer
- Country Case Study at the World Bank Knowledge Economy Forum II, Helsinki, March 2003
- Organises the annual European Day of the Entrepreneur;
   Intel Berkeley Technology Entrepreneurship Challenge for Central and Eastern Europe



### ICT related projects

- 10 projects from 6-th Framework RTD Programme
- 15 projects from 5-th Framework RTD Programme
- 7 projects from 4-th Framework RTD Programme (INCO COPERNICUS)
- Many other national and international eLearning related projects:
  - internal (at Sofia University);
  - with the Ministry of Education and Science and Ministry of Transport and Communications
  - at EC level (PHARE, Socrates-Minerva, Leonardo, Comenius)
  - World Bank, Industrial, bilateral with other universities, etc.



#### Projects from FP6

- 6FP NoE Project KALEIDOSCOPE "Concepts and methods for exploring the future of learning with digital technologies",
- 6FP IP Project TenCOMPETENCIES: Building The European Network for Lifelong Competence Development
- 6FP STREP Project UNITE: Unified eLearning Environment for the School
- FP6-2004-IST-NMP-2 PRIME "Providing Real Integration in Multi-disciplinary Environments"
- 6FP SSA Science.and.Society.7 Project PARCEL "Participatory Communication Activities on E.Learning"
- FP6 SSA 016020 **ATVN-EU-GP** "Academic Internet Television Showcases the Best of Good Practice Activities"
- 6FP IP Project **GUIDE** "Creating an European Identity Management Architecture for eGovernment", http://www.guide-project.org
- 6FP BulRMCNet "Bulgarian Network of Research Mobility Centres"
- FP6 MOBILITY-2004-SSA REKS "Researchers in European Knowledge Society"



#### Projects from FP5

- 5FP IST-2002-5.1.15 (2002-2005) MECITV Project: "Media Collaboration for Interactive TV"
- 5 FP IST Project "DIOGENE: A Training Web Broker for ICT Professionals" - http://www.diogene.org/
- 5 FP 2001/C 321/17 (2002-2005) GEM-Europe Project: "Global Education in Manufacturing"
- 5 FP IST Project "WebLabs: new representational infrastructures for learning", http://www.weblabs.eu.com
- 5 FP IST-1999-20852 (2000-2002) "Best Practice Pilot for the Promotion and Implementation of Teleworking Tools at European SMEs of the Service Sector (PROTELEUSES)"
- 5FP Innovation and SMEs IPS-2001-41103 PROMOTOR+ Project:
   "Collaborative Validation and Transfer of Regional Support Measures for Start-ups and Growth in Five NACs Regions"
- 5FP IPS-2000-056 (2001-2003) EIM CEE Project: "Euro Innovation Manager Central and Eastern Europe"



- 5 FP "Best Practice Pilot for the implementation of Integrated Internet Based Remote Working Places for Virtual Teams (IWOP)"
- 5 FP "A Picture of Social Observation of Call Centre (TOSCA)"
- 5 FP WG-ECUA+: European COTS Working Group Extension
- 5 FP EXPERT Project: "Best Practice on E-project Development Methods"
- 5 FP COCONET "Context Aware Collaborative Environments for Next Generation Business Networks"
- 5FP IST Project EUNITE EUropean Network on Intelligent TEchnologies for Smart Adaptive Systems
- 5 FP INNOCONS: Increasing The Awareness On Innovation In The European Construction Sector
- 5FP AFORO Project: "Agro-Food Roadmaps. A vision and work plan to implement future RTD trends for the transformation of agri-food industries into digital companies"
- 5 FP Innovation and SMEs Thematic Networks, BIGEAR NET Thematic Network on Stimulation of Business Innovation and Growth from Exploitation of Academic Research

## European Dimensions of Informatics Education "Quo Vadis" Europe? – Bologna & Lisbon 2010

- EU suffers from under-investment in human capital, especially in higher education;
- Europe faces a chronic shortage of skilled ICT professionals demand is expected to exceed supply by around 12% per year over the coming years;
- Need to increase of at least 15% in the number of Math, Science and Technology graduates by 2010;
- Increase of 1.2 mln R&D staff, incl. 700,000 researchers, will be needed by 2010;
- EU produces more science graduates than the US, but has significantly fewer researchers in the labour market;
- Brain drain' 85,000 EU-born S&E employees work in the US;
- Europe of Knowledge: convergence of European Higher Education Area and European Research Area; Knowledge Triangle (education, research, innovation);
- European Technology Platforms and European Institute of Technology;
- European Year of Worker's Mobility 2006 mobility of researchers, teachers and students as a mean for preventing brain drain;
- Erasmus University Charter and Erasmus Student Charter (2003);
- European Charter for Researchers and a Code of Conduct for the Recruitment of Researchers (2005).



## Intel seminar "The Role of Universities in the Creation of a Knowledge-based Economy" (12 October 2006)

- Modernization of European Universities (EU Education Commissioner Ján Figel)
- University funding models across Europe (Minister Micheál Martin)
- Investing in Higher Education (Dr. Craig Barrett)
- The Establishment of Elite Universities in Germany (Prof. Arndt Bode)
- From Brain-Drain to Brain-Circulation: the New Member States Perspective (Dr. Roumen Nikolov)



The eLearning Industry Group: "eLearning has the potential to become a key engine in driving growth and creating more and better jobs in Europe."



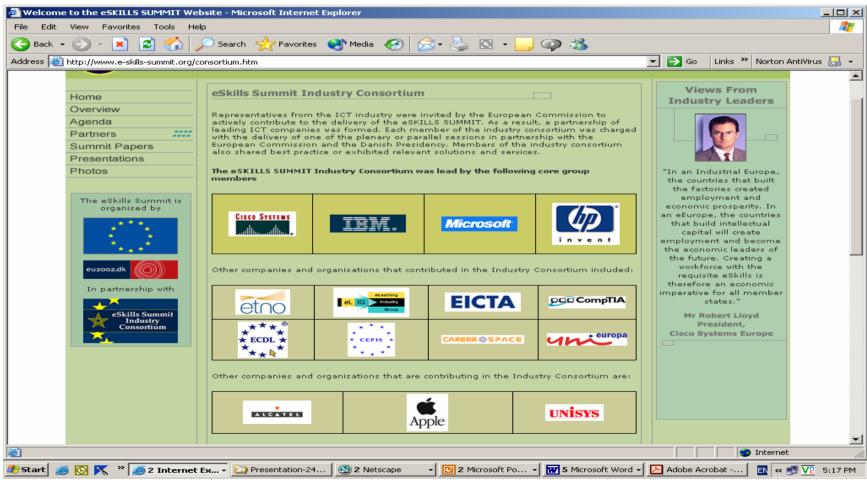


#### E-Skills Summit, Kopenhagen, 17-18.10.2003





#### E-Skills Summit Industry Consortium & 25 Pilot Universities



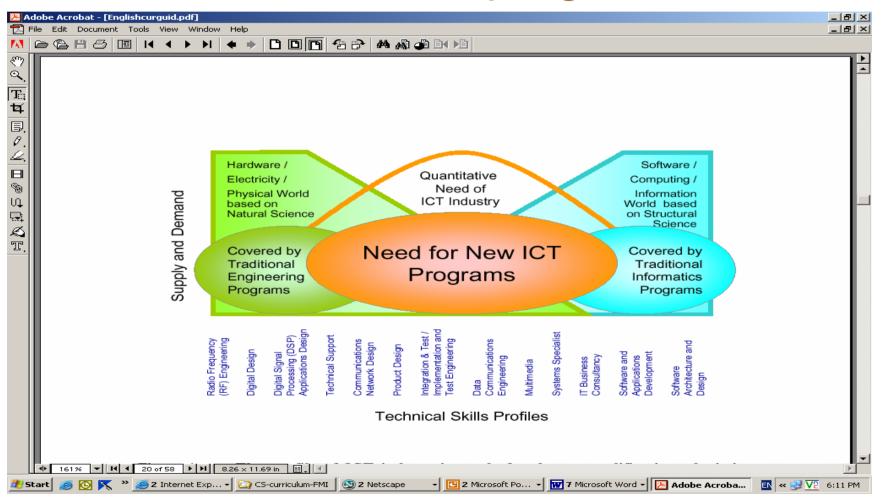


#### E-Skills Summit: Documents & Guidelines

- Curriculum Development Guidelines
   New ICT curricula for the 21st century: designing tomorrow's education
- Determining the future demand for ICT skills in Europe
- ICT Job Profiles
- ...

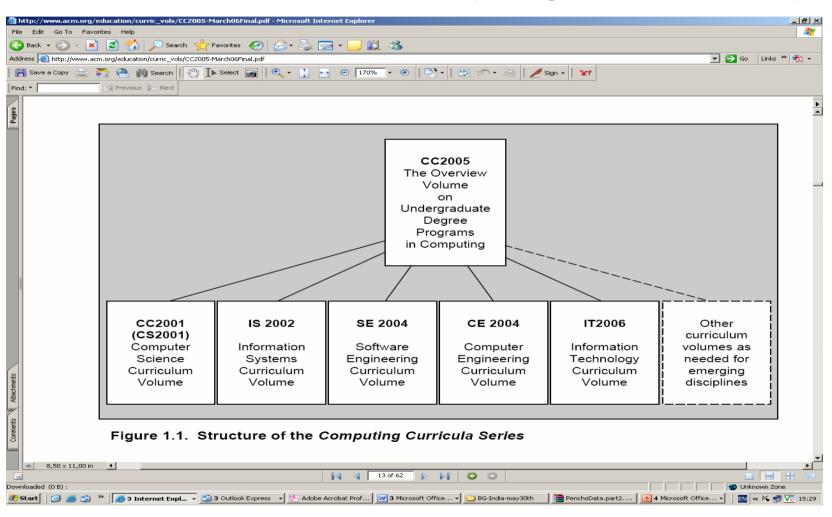


#### The need of new ICT programs





#### ICT Standards – ACM/IEEE Computing Curricula 2005 (CC2005)





## Implementing ACM/IEEE CC2005 at Sofia University

- BSc in Computer Science
- BSc in Software Engineering
- BSc in Information Systems
- wide variety of MSc programmes
- PhD level



Computer
Science

- Software specifications and design
- Project management
- Documentation
- •Human-computer interaction

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- Designing and reasoning about
- Business value of information technology
- Strategic use of information technology
- Business processes
- Evaluation of emerging
  - Database design
    - Info storage and retrieval
    - •Artificial intelligence
    - Intelligent decision systems

-database design
-info storage and retrieval
-artificial intelligence
-intelligent decision

systems

∠ology:

information

- -programming -databases
- -networks
- -hardware concepts
- -legal and ethical is:
- -software
- specification and design
- -project managen
- -documentation
- -human compute

-hardware - software
interfaces
 -software methodologies,
standards and metrics
 -software performance,

security and safety

Programming

- Databases
- Networks
- Hardware concepts
- Legal and ethical issues

Information \_\_\_\_ Systems

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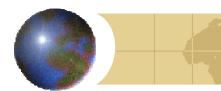
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Software

Engineering



#### MSc Programs in Informatics

- Artificial Intelligence
- Computational Science and Engineering
- eBusiness and eGovernment
- eLearning
- Medical Informatics
- Information Systems
- Mobile Technologies and Distributed Systems
- Software Engineering
- Information Security
- Computer Graphics
- Mechatronics and Robotics
- MSIS Stevens Institute of Technology



Stevens MSIS Program: Importing IT Management Competence at Sofia University (http://www-it.fmi.uni-sofia.bg/msis/)





#### Become a Leader in Information Technology Management



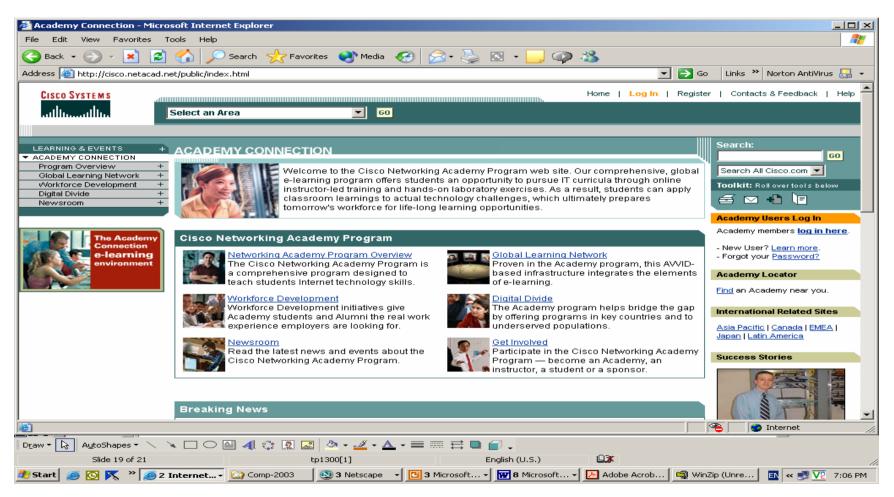
#### We have what you need!







#### Regional Cisco Academy





#### Chronology

- 2000: established Regional Cisco Academy at Sofia University
- 2000-2001: certified 8 CCAI
- 2001: started teaching CCNA1-4
- 2002: started teaching IT1&2,
   Fundamentals of Java, Fundamentals of Unix
- 2003: started teaching CCNP
- 2005: started teaching Wireless LAN & Network Security courses



#### Cisco courses integrated in the University curriculum

#### **Faculty of Mathematics & Informatics**

BSc Computer Science - CCNA1 (since 2001/2002)

MSc Distributed Systems & Mobile technologies

- CCNA1-4 (since 2004/2005)
- Wireless LANs (since 2004/2005)
- IT Essentials 2 (since 2004/2005)
- Network Security (since 2005/2006)

#### **MSc Information Systems**

- CCNA1 (since 2003/2004)
- Fundamentals of Unix (since 2003/2004)

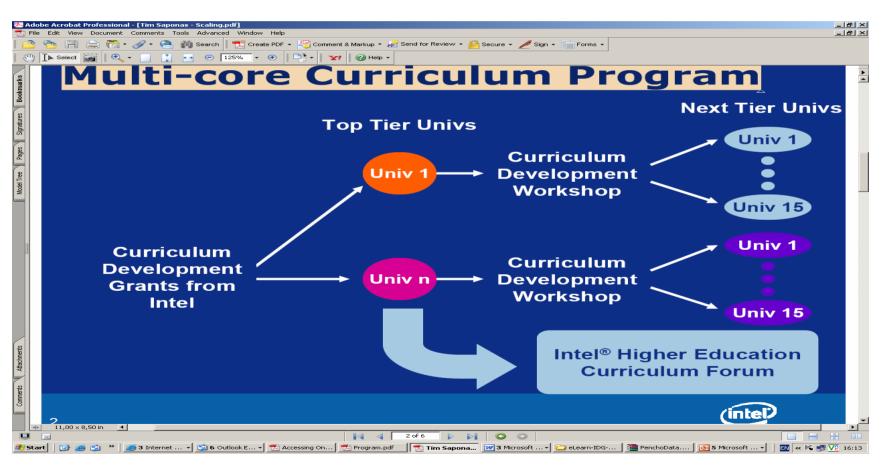
#### **Faculty of Economics & Business**

MSc Management Information Systems

- CCNA1 (since 2003/2004)
- Fundamentals of Unix (since 2003/2004)



## ICT Curricula Dynamics: Intel Multi-core Curriculum Program, Sofia University joins the Top Tier University Club





#### The Role of New Member States in Europe of Knowledge

- During the last 15 years the Bulgarian population has decreased by nearly 1 mln people, most of them – young and well educated specialists who fuel the Western economies. Many cases of 'brain-waste' for EU: e.g. a former CEEC researcher working as a plumber in the US or in the EU;
- CEECs loose their great investments in education (for Bulgaria the loss is bigger than the national debt);
- By February 2002, 14% of the Marie Curie fellowship holders from CEECs moved to the EU and only 0.5% of fellowship holders from the EU moved to a CEEC country.
- Erasmus, Leonardo and ERA-MORE: are they mechanisms to speed up the 'one-way' mobility? Are the CEECs considered as the main suppliers of high-skilled workers?
- Andrea, A Czech student, says "You just can't compare our infrastructures or the investments we make in the education and scientific sectors with that of other European countries
- Howard Moore, Director, ROSTE, UNESCO: "The countries of South-East Europe share some common problems to a greater or lesser extent low investment in science, inadequate infrastructure in terms of research equipment; libraries, low industrial base and therefore very limited private sector involvement in science, and those issues lead to the chronic brain drain".



#### From Brain-Drain to Brain-Circulation – How To?

- The Irish model ("Celtic Tiger") from Brain-Drain (1980) to Brain-Gain and Brain-Circulation (1990 +);
- Commissioner Janez POTOČNIK (April 2006, Sofia): "Bulgaria should also plan the use of other EU instruments to achieve knowledge and growth. I am thinking of the Competitiveness and Innovation Programme but even more so of the use of the Structural Funds to promote research objectives".
- Ireland has used 60% of the EC development funds for infrastructure (highways, railroads, airports, harbours), and invested most of the rest for infrastructure for the Knowledge Economy (universities, research labs, innovation and entrepreneurship, high-tech infrastructure, improving competitiveness of economy). Effect economic boom.
- Portugal used 90% of the EC funds for building traditional infrastructure. Effect economic crisis.
- Lisbon strategy: "Implementation of the strategic goal will be facilitated by applying a new open method of co-ordination as the means of spreading best practice and achieving greater convergence towards the main EU goals".
- Is the EC ready to use this method for strongly guiding and monitoring (even forcing) the NMS to apply the EU best practice models for brain-reverse (e.g. the Irish, Finish, Swedish, Danish, UK)?<sub>ECSS 2006</sub>



#### Building Europe of Knowledge Ecosystem

- Building a pan-European educational and research infrastructure
- Stimulating short-term and virtual mobility, rather than long term geographical one;
   Establishing better system of incentives for return back
- Establishing a European large network of virtual educational, research, innovation, technology transfer and business organisations
- Stimulating research activities and entrepreneurial education at early stages of education, even in the schools
- Establishing stronger mechanisms for technology transfer and knowledge mobility between EU-15 and NMS, including between different sectors, as a pre-condition for competitive business development
- Lifting the barriers for students, teachers and researchers for building their high-tech business start-ups
- Stimulating venture capital invasion, especially for early stage businesses
- Awareness-rising initiatives and events aiming at and building entrepreneurial culture as early as possible
- Building public-private partnerships for investments in educational and research infrastructure



#### Education and Research as a 'Meta-Industry'

- ICT is the main instrument for turning education and research in an industry (eLearning, eResearch, eWork, eInfrastructure);
- eLearning in Informatics Education as a mean to overcome the e-skills gap
- This industry could be considered a 'meta-industry' since it could positively influence all other industry sectors;
- It could become the most important asset of the NMS on their way to the Knowledge Economy;
- NMS are attractive destinations for foreign direct investments (FDI), that have radically changed many industry sectors, e.g. the food and beverages sector, cement industry, non-ferrous metallurgy, wholesale trade and banking in Bulgaria;
- FDI could radically change the 'knowledge sector' of the industry which should be built around the real knowledge producers universities and research institutions;
- We might expect a radical change in building sustainable 'university-industrygovernment' partnerships in NMS;
- This is a real chance for Bulgaria to leap forward into the 'Knowledge Economy'



#### Conclusion

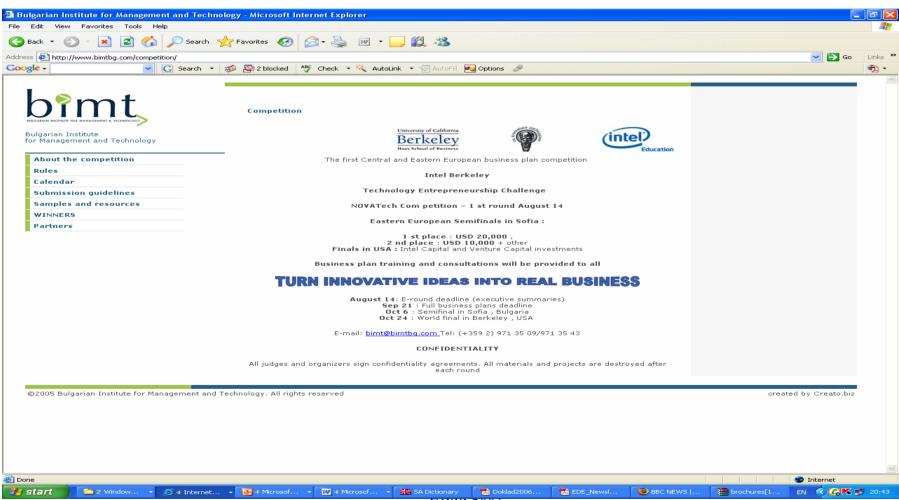
Informatics education is not just an academic exercise

It can be considered a main catalyst for stimulating growth and creating a competitive economy



### Recent ICT public events

## Intel Berkeley Technology Entrepreneurship Challenge for Central and Eastern Europe, August-October, 2006





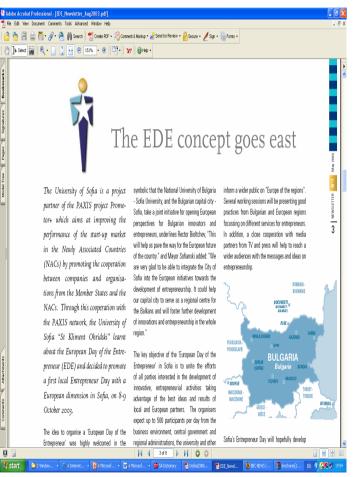
## IEEE 2006 John Vincent Atanassoff International Symposium on Modern Computing, October 2006





### Forthcoming events

#### 4th Sofia European Day of the Entrepreneur – November 7-8, 2006



- Main organisers: Sofia University and Sofia Municipality, in cooperation with the EC, Bulgarian Government, businesses, universities, SMEs, etc.
- Sofia the first CEEC capital hosting EDE (2003);
- So far: 1500 visitors, 70 co-organisers, 100 foreign participants, 250 lectors, many satellite events, media coverage;
- EDE2006 under the motto "European Funds and Regional Development"



## 3<sup>rd</sup> Balkan Conference in Informatics – BCI'2007 27-29 September 2007, Sofia, Bulgaria





### Thank you for your attention!