Smart Solutions: "Master Class" – Part 1

- Defining Smart Solutions & Business Architectures -

Dr David E. Probert
VAZA International

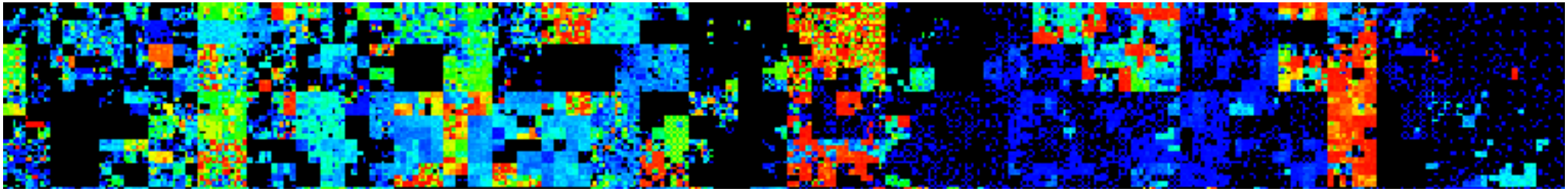
Smart Business Solutions *"Troika":*

- Economy, Security and Governance -

Russian "Troika" - Donetsk, Ukraine - 1880s – www.Valentina.Net/e-archive.html

Defining Smart Solutions & Architectures

1 – Background Perspectives	**2 – ICT Genes for Smart Systems**	**3 – From Genes to Smart Architectures**
4 – Industrial 20thC to Smart 21stC Economy	**5 – Smart "Real-Time" 21stC Armenia**	**6 – Transforming Economic Sectors**
7 – Smart Sustainable Security	**8 – Principles of Smart Governance**	**9 – From Smart Theory to *"Best Practice"***



Smart "Master Class": Mission Aims

1) ***Theory:*** Define theory of Smart Systems, and Briefly Review their Evolution from the 20thC to 21stC

2) ***Practice:*** Translate Theory to Business Practice, focusing on primary economic market sectors

3) ***Design:*** Work within Teams to Design a Prototype "Smart Solution" for selected marketplace

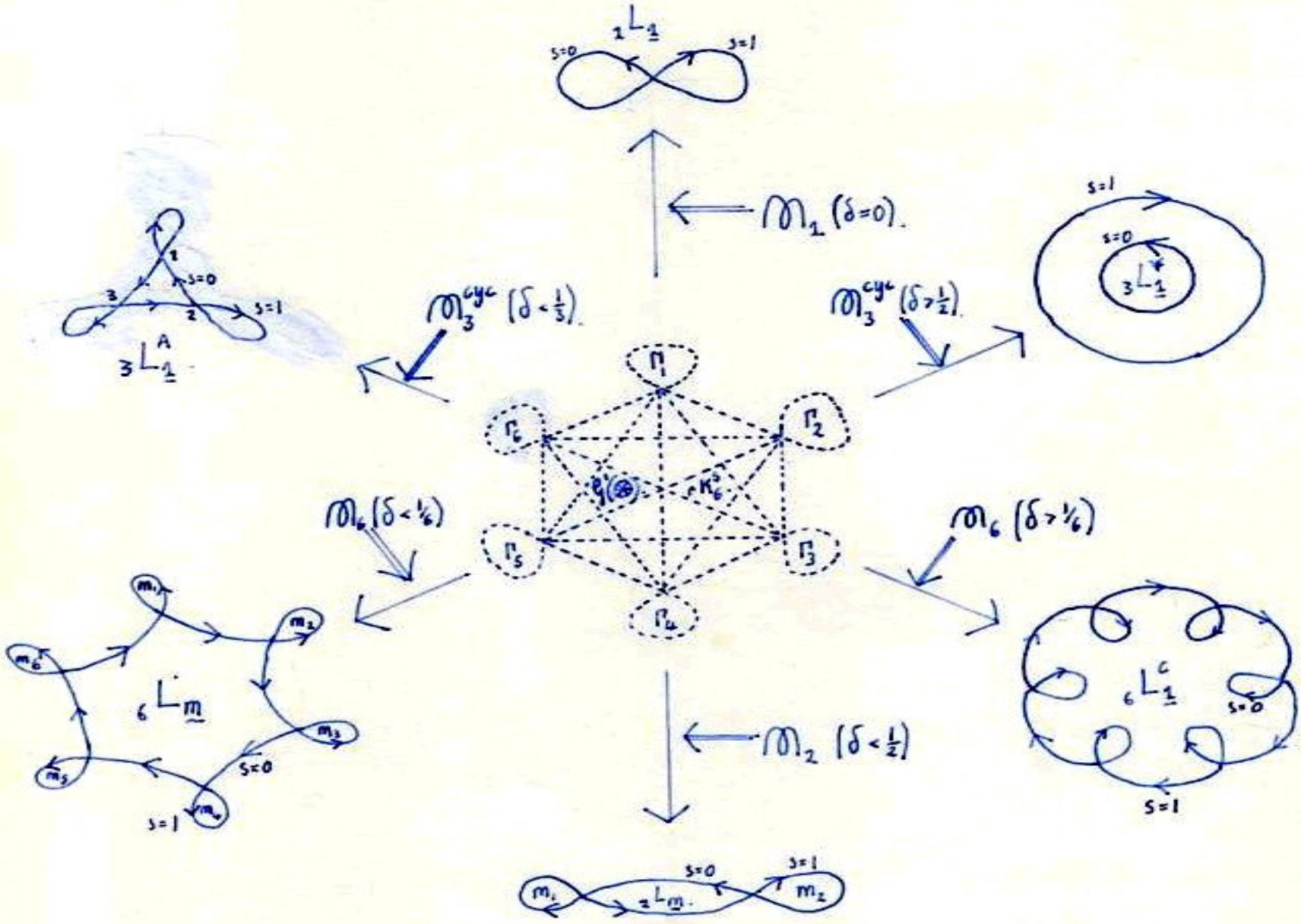
"What are "Smart Systems"?

- ***Definition:*** Smart Systems are able to adapt, learn and interact with their environment. In this way they make decisions, update their structures & display "intelligence".
  - ***Smart Pioneers:*** The first primitive "smart systems were based upon the early mainframe computer programmes during 1950s/1960s
  - ***Artificial Intelligence:*** Cybernetics, Systems Dynamics, AI & Expert Systems became mainstream research themes during the 1970s/1980s
  - ***"Smart Devices"*** - The development of microprocessors & component miniaturisation has allowed evolution of more advanced smart products such as mobile gadgets and robotics during the early 21stC
  - ***"Smart Practice"*** - The current implementation trends are to scale-up "Smart Solutions" to be implemented in key economic sectors, communities, cities, and countries

Historical Trends in "Smart Systems"

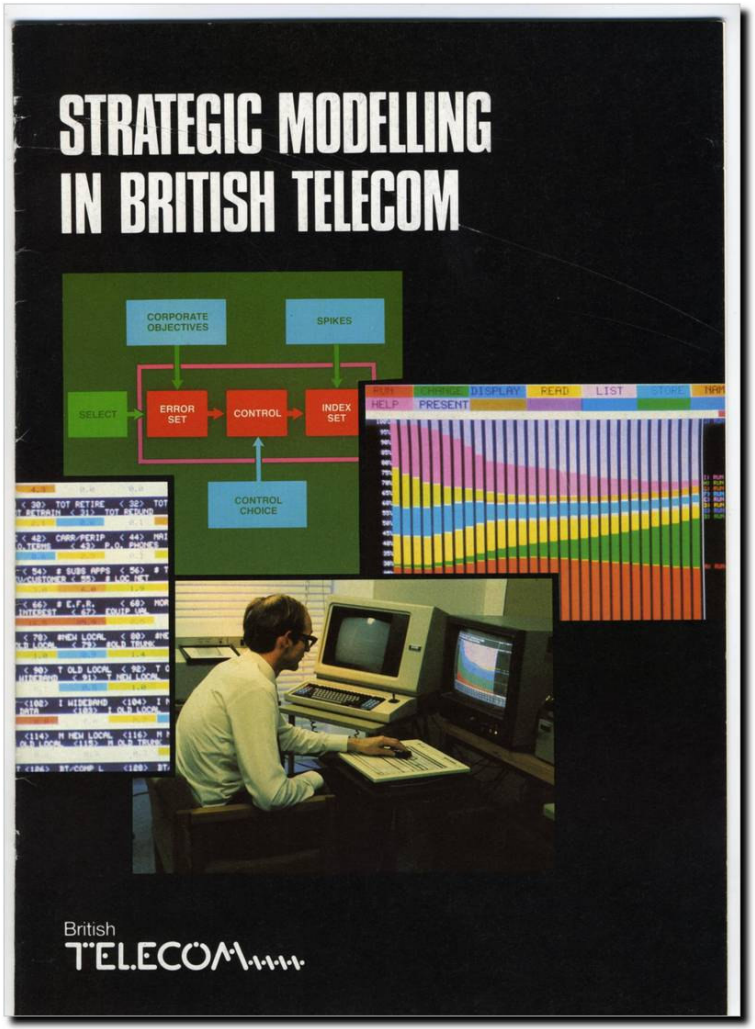
- ***R&D:*** Relevant Research Fields that supported the development of "Smart Systems" include:
  - ***Cybernetics & Automata:*** Developed since 1948 by pioneers such as Norbert Wiener, Von Neumann, Stafford Beer
  - ***System Dynamics & Simulation:*** Developed from late-1950s onwards by Jay Forrester & Team with their seminal works such as Industrial, Urban and World Dynamics
  - ***Artificial Intelligence, Expert Systems & Neural Nets:*** Mainstreamed during the 1970s by teams at MIT, Carnegie Mellon & Edinburgh Universities. Now extensively used in many business applications including Real-Time Trading.

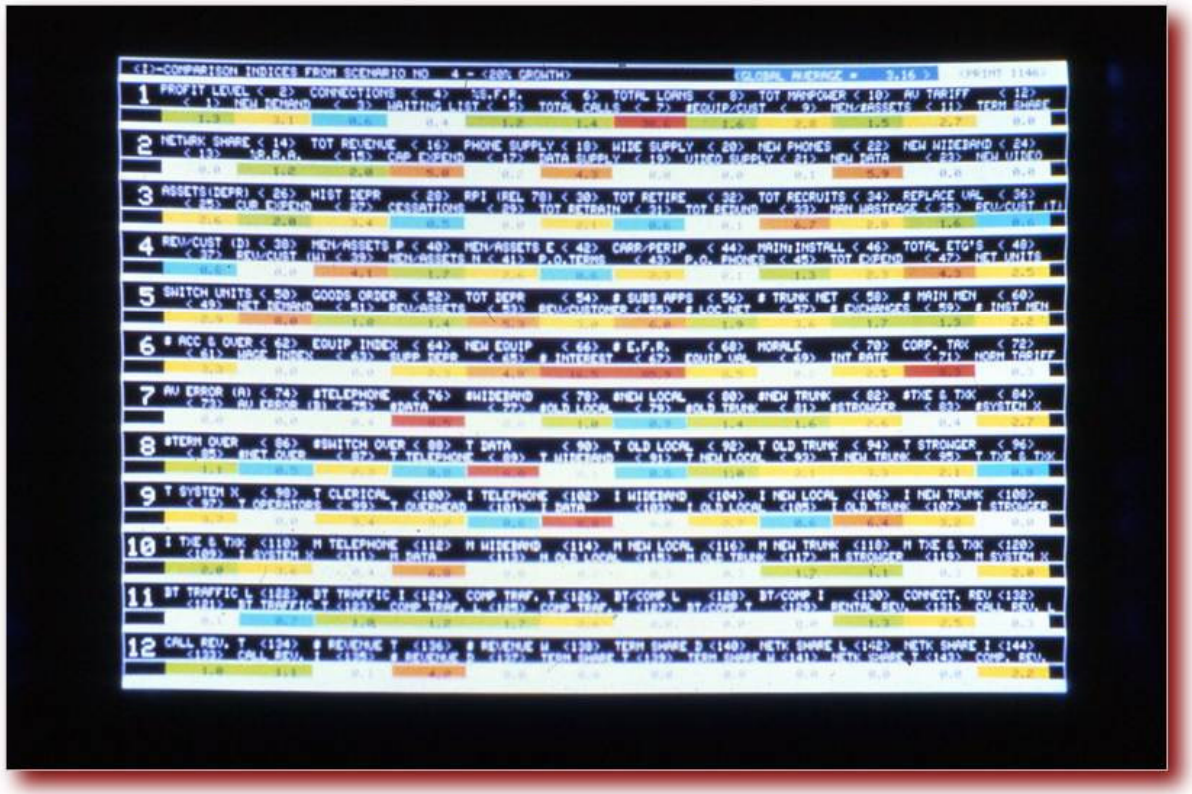
Evolution of Stochastic Automata – *Cambridge, June '76*



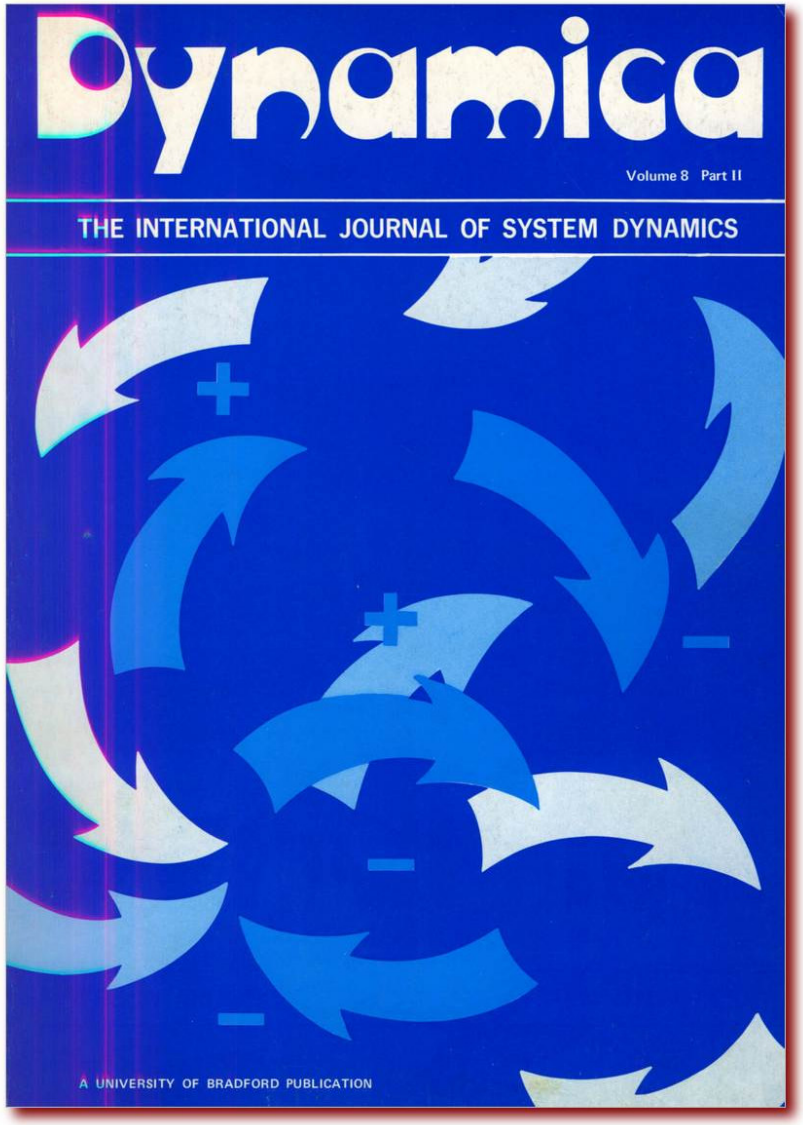
Frontispiece:- "The Adaptation of Automaton $g'(\otimes)$ in Environments $\mathfrak{M}_0$".

“Smart Telecommunications Business Modelling & Simulation” – *1982*





“System Dynamics” – ICT Business Simulation- *1982*



SYSTEM DYNAMICS MODELLING WITHIN THE BRITISH TELECOMMUNICATIONS BUSINESS

Dr. D.E. Probert, Long Range and Strategic Studies Division, British Telecom.

D.E. PROBERT is currently Head of the Strategic Modelling Group within British Telecom's Long Range and Strategic Studies Division which is located at Cambridge, England. After obtaining his BSc degree in Mathematics from the University of Bristol in 1973, he spent three years undertaking research into the dynamics of self-organising systems at the Statistical Laboratory, Cambridge University, where he obtained his PhD in 1976. During 1976-1978, he was engaged by BT as a consultant to develop a comprehensive dynamic corporate model of the British Telecommunications Business, with a planning horizon of between 20 and 30 years.

ABSTRACT

British Telecom's Strategic Modelling Group has been actively involved in system dynamics modelling since 1976 when it was decided to develop a dynamic corporate model of British Telecom with a planning horizon of around 30 years. This research project was successfully carried out in collaboration with the Department of Control and Management Systems, Cambridge University. We have since developed a strategic control module which allows us to track a set of corporate objectives and also to analyse the robustness of the business under various imposed crises.

More recently an Integrated Communications Demand Model has been developed by a research team at Cambridge University, in close liaison with British Telecom. The conceptual framework of this model spans the entire marketplace for physical and electronic communications media. It is currently undergoing validation tests and tuning to the best available data, focusing upon the expected growth rates and market shares for new services.

We have placed considerable emphasis on the development of a "user friendly" interface for all our dynamic models, in which we now use an intelligent colour graphics terminal linked to a mainframe computer. All commands and policy options are entered through a menu pad which means that our models are evolving into being more permanent forms of decision support system, which can be used by the non-specialist user.

0. INTRODUCTION

0.1 BACKGROUND

System dynamics modelling has been used in the formulation and implementation of strategic planning models for nearly five years within the Long Range and Strategic Studies Division of the British Telecommunications Business. This modelling has proceeded in close collaboration with the Department of Control and Management Systems of Cambridge University.

It was decided in 1976 that with the rapid changes in the telecommunications marketplace, which have since led to a new Telecommunications Bill, it was essential to have a dynamic computer-based representation of the corporation. Such a model was developed using the methodologies of system dynamics and became operational early in 1978. This corporate model has been actively used for over four years during which time several thousand computer runs have been conducted under a range of policy assumptions. More recently we have developed a strategic control unit which allows us to track a set of objectives placed on key business indicators. In addition, the control unit is frequently used to evaluate the response of the business to selected crises in which the corporate objectives are usually those of the current British Telecom Corporate Plan. Thus we are able to design both a desirable and robust corporate future which can act as the basis for more detailed studies.

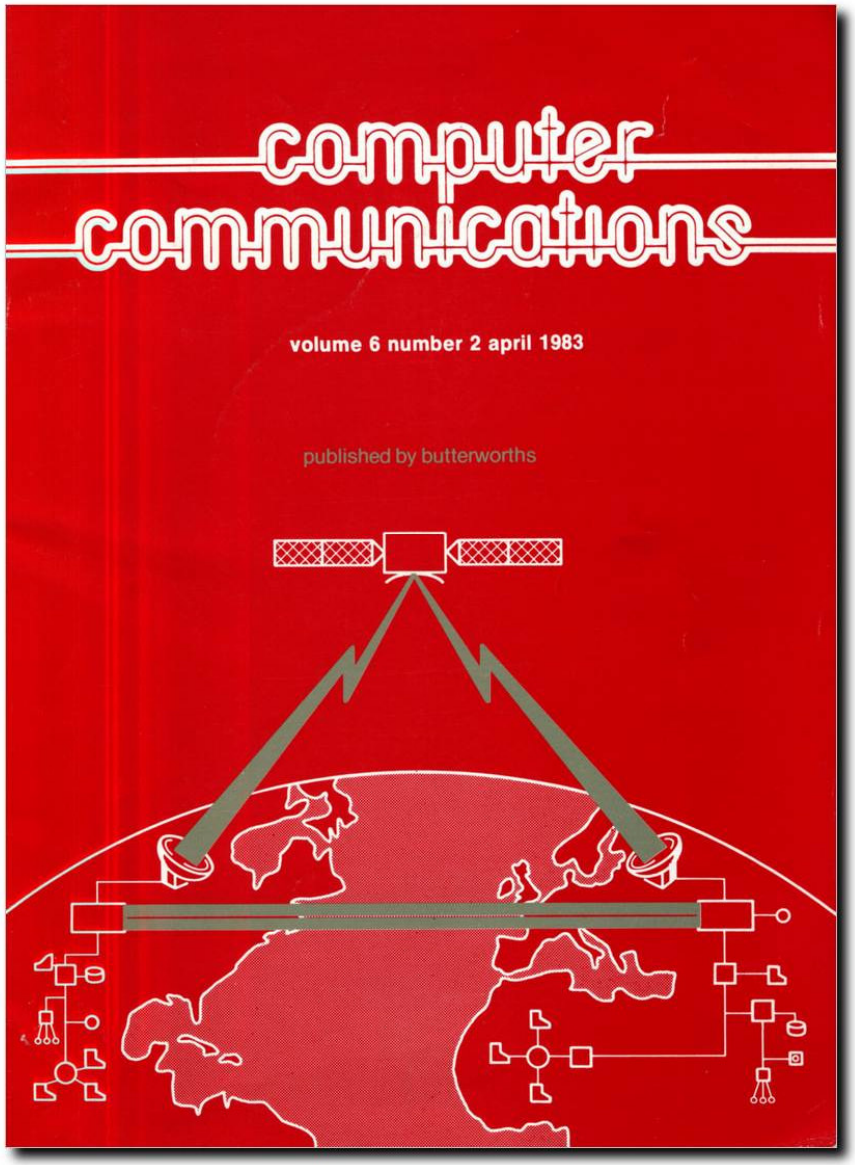
The corporate model is now run on an intelligent graphics terminal linked to a main-frame IBM 3033 over the public telephone network. A central theme of this paper is that of interfaces in which we emphasise the importance of creating a "user friendly" interface if the manager is not to be alienated by computer models. During the last 18 months during which the colour graphics interface has been operational, we have found far wider acceptance of the model through numerous successful "live" demonstrations to senior managers.

The success of the corporate model (commonly referred to as the Long Range Planning Model or LRPM) led us to take the Marketing Module as the starting point of a new research project. This new model is known as the Integrated Communications Demand Model (ICDM) in which we have now completed the development of the conceptual framework and its implementation in FORTRAN using the same colour display package. We are currently devoting most of our effort to "tuning" up the ICDM to produce an acceptable base projection for future market studies. The demand model includes the demand for all communications media in which the focus is upon the possible substitution of physical media such as transportation and postal systems by electronic media.

0.2 INTERFACES

An important role for any model is that it creates a unified language in which to discuss issues which cut across a multitude of operational boundaries. We must note that the LRPM is a comparatively large dynamic model occupying around

“Expert Systems” in ICT Policy Analysis - *1983*



Towards expert systems for telecommunications policy analysis

David Probert discusses how expert systems can complement traditional simulation models

Telecommunications policy analysis is currently a highly complex arena of debate. Systems have been developed by British Telecom which replace traditional simulation models. The paper reviews the progress to date within BT, discusses topics for future research and suggests what can be usefully gained from the application of expert systems to policy analysis and evaluation.

Keywords: computer systems, telecommunications, policy analysis, expert systems

Telecommunications policy analysis is currently a highly complex arena of debate, in which there is also very considerable uncertainty as to the eventual outcomes. Over the last five years, in collaboration with Cambridge University, British Telecom (BT) have undertaken a considerable amount of research into developing computer packages which allow them to explore the strategic options available.

The prime focus of this research has been the development and implementation of a long range planning model (LRPM) which has a flexible core of several hundred policy parameters. These can be manipulated to generate a wide spectrum of alternative corporate futures. A strategic control unit allows them to study the impact of crisis on the business in which the model itself generates feasible paths to recovery whenever this is possible. The controller will also track a set of up to about ten corporate objectives, which will in general be ranked according to their relative importance.

Considerable importance has been placed on the development of a 'user friendly' interface for the LRPM, which is now running on an intelligent colour graphics terminal linked to a mainframe IBM 3033 over the telephone network. All commands and policy options are entered through a menu pad, while the outcomes under a given corporate policy require only about 5 s CPU run time before being compared with outcomes from alternative policies. This leads to rapid interactive policy analysis and evaluation. An Integrated Communications Demand Model (ICDM) has been developed by a research team at Cambridge University, in close liaison with BT. The conceptual framework of this model spans the entire marketplace for physical and electronic communications media.

The next stage of research into computer-based tools for policy analysis concerns the problem of how far the computer package can be programmed to interpret the results from a given policy option. Perhaps initially the program can only be expected to suggest which of several hundred output variables are most worthy of examination under a particular corporate policy. There seem to be relevant analogies here with chess playing programs and algorithms for path evaluation. A further important research problem concerns the mechanism whereby the analyst is able to interrogate the model to explore why particular outcomes arose from the chosen policy options. At present, there has been no attempt to include such intelligence into the policy models, but its inclusion at some future date could do much to increase the

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The views expressed in this paper are those of the author, and are not necessarily shared by British Telecom

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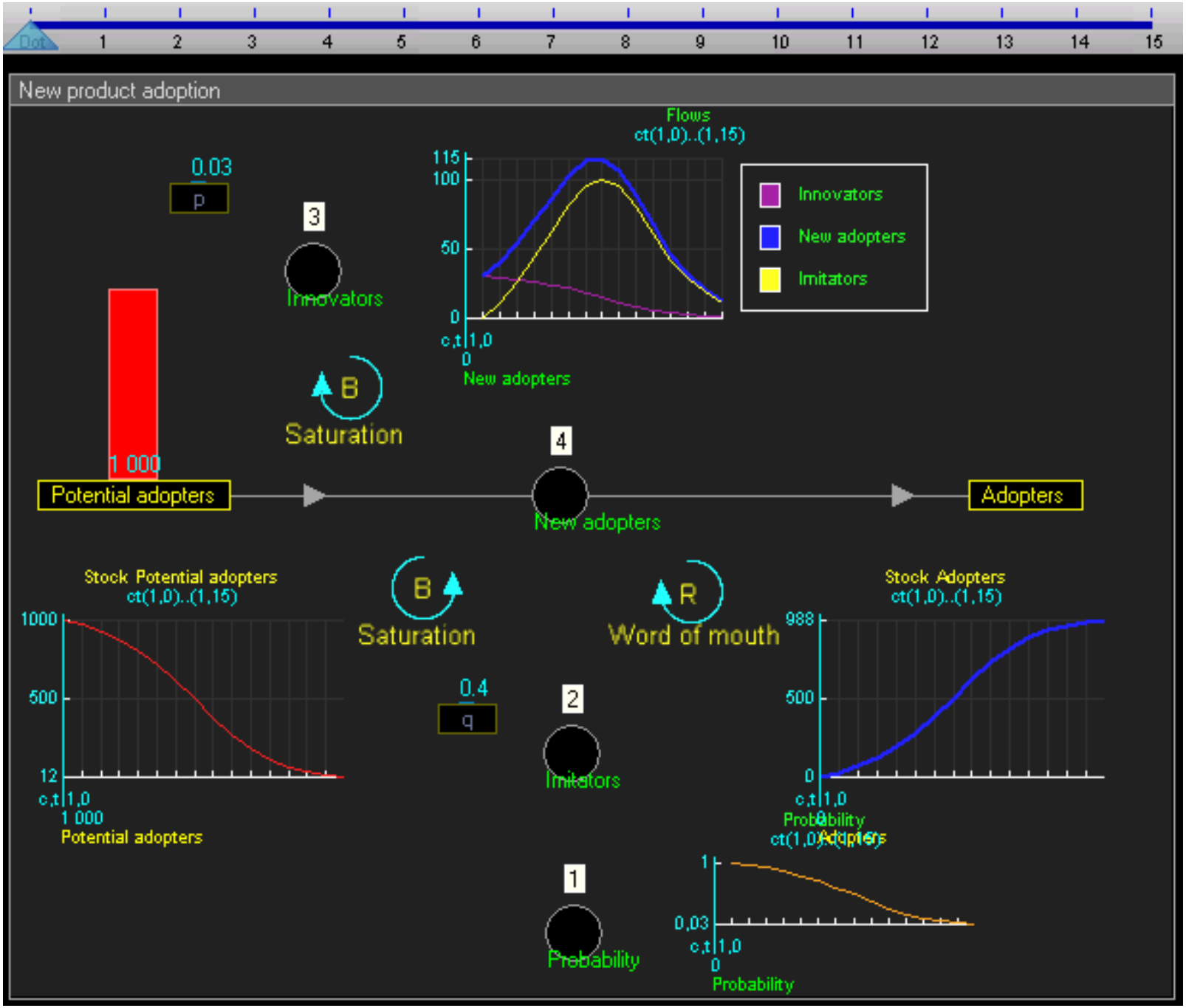
“System Dynamics” – *Business Simulation*

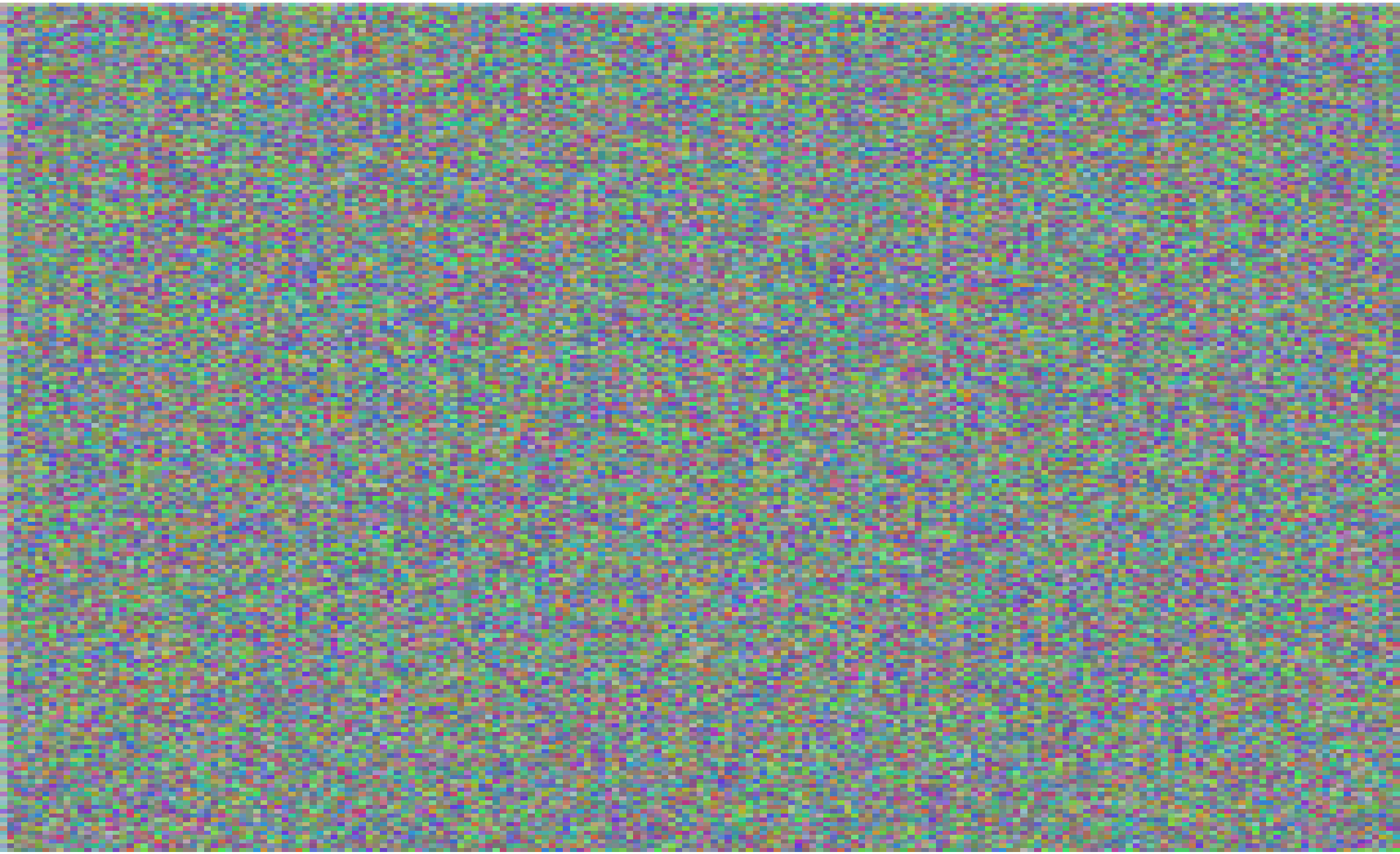


Cellular Automata: *"Game of Life"*

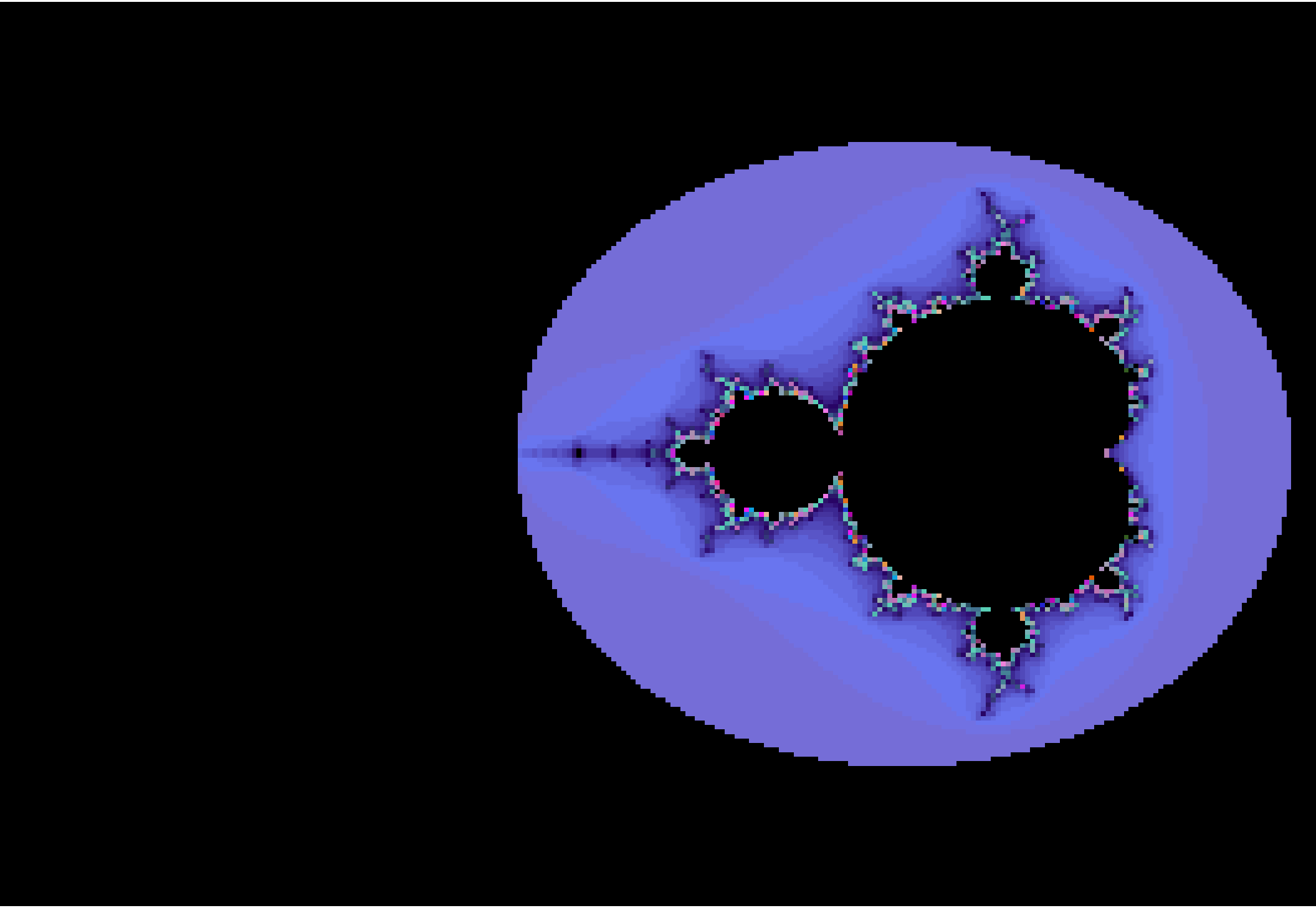
…."Simple" Rules may Lead to "Smart" Complex Behaviour!

2D Cyclic Cellular Automaton:

- Emergence of Patterns from Random Chaos -

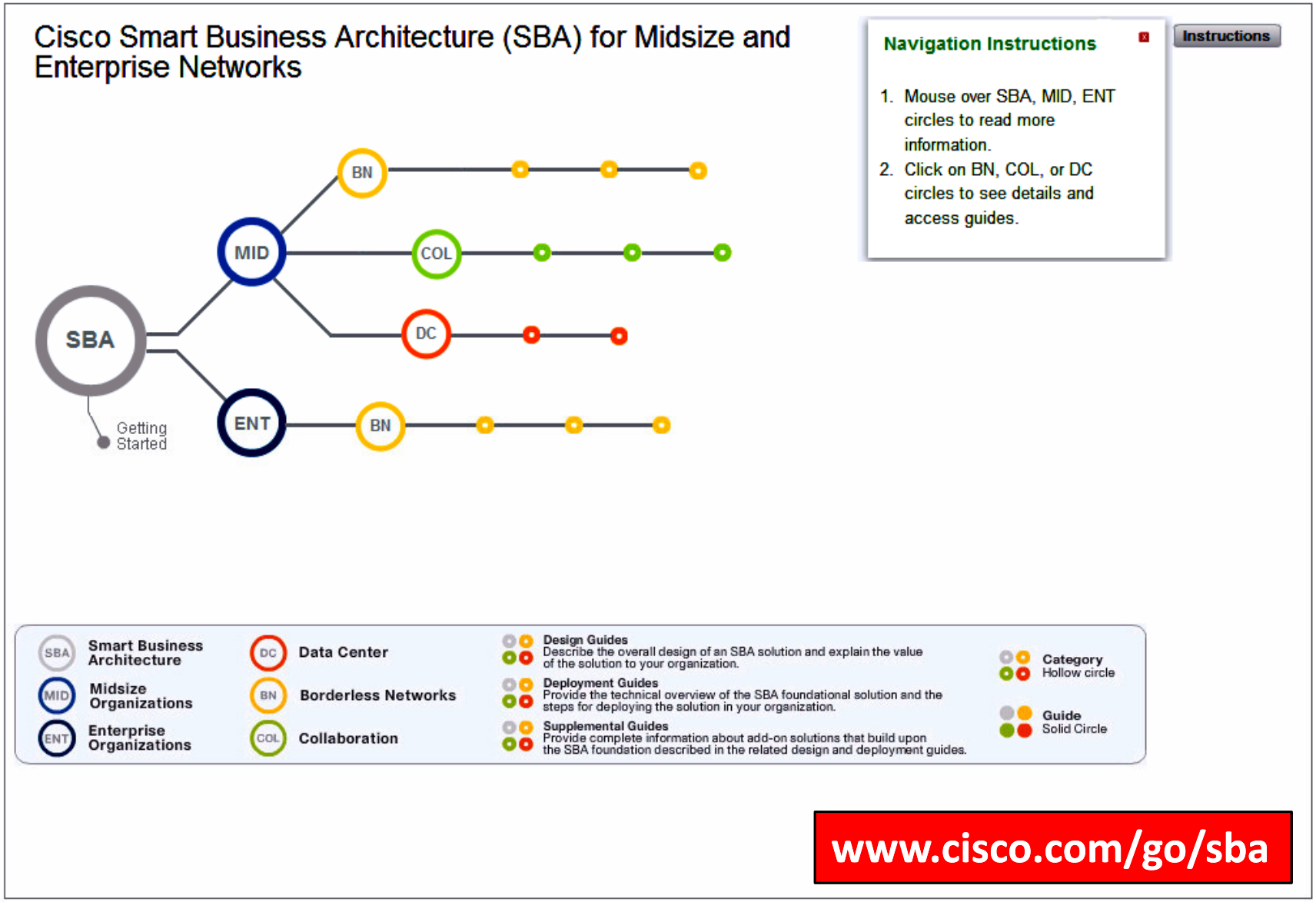


“Smart Scaling”: *Fractal Mandelbrot Set*

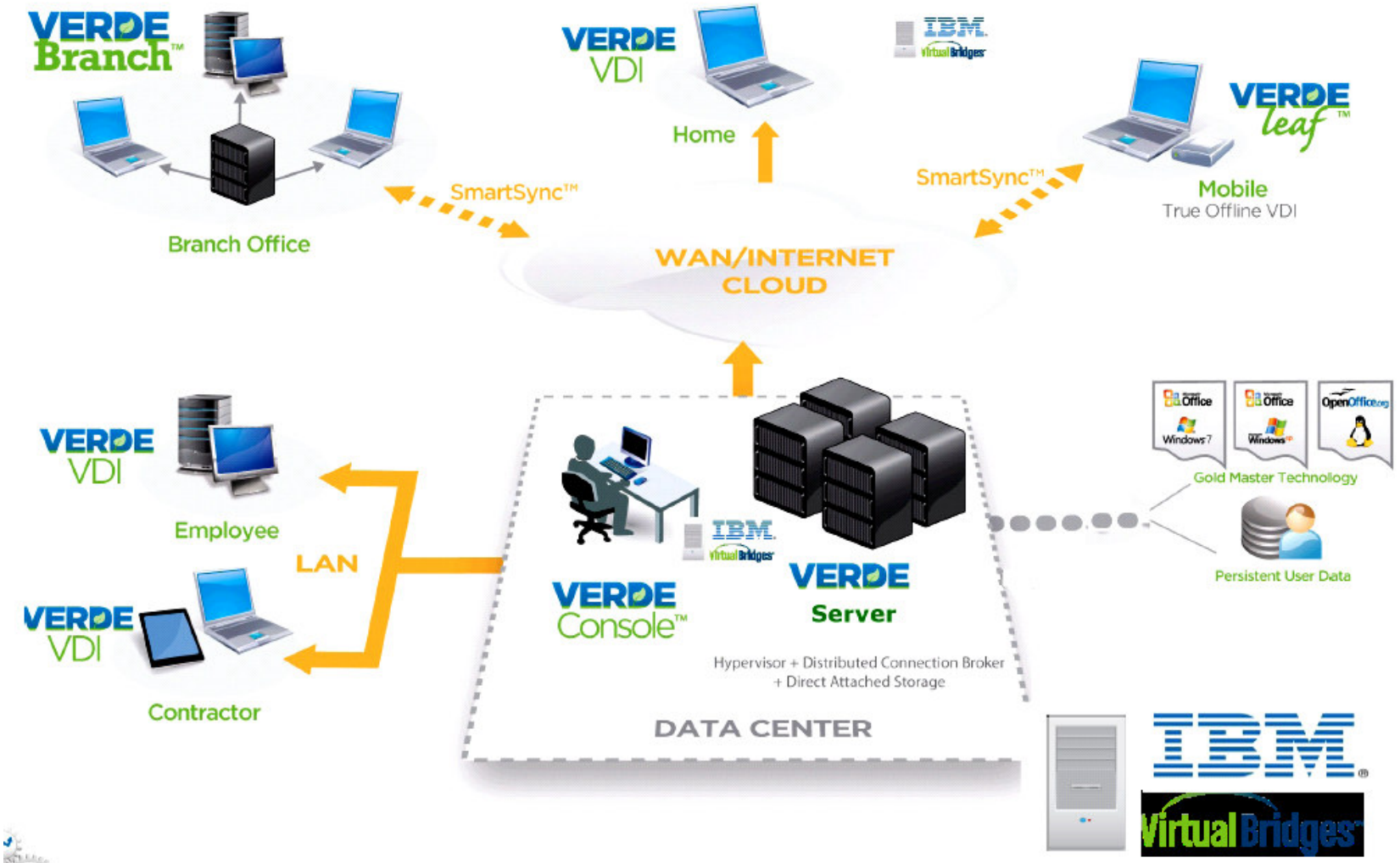


CISCO: *"Smart Business Architecture"*

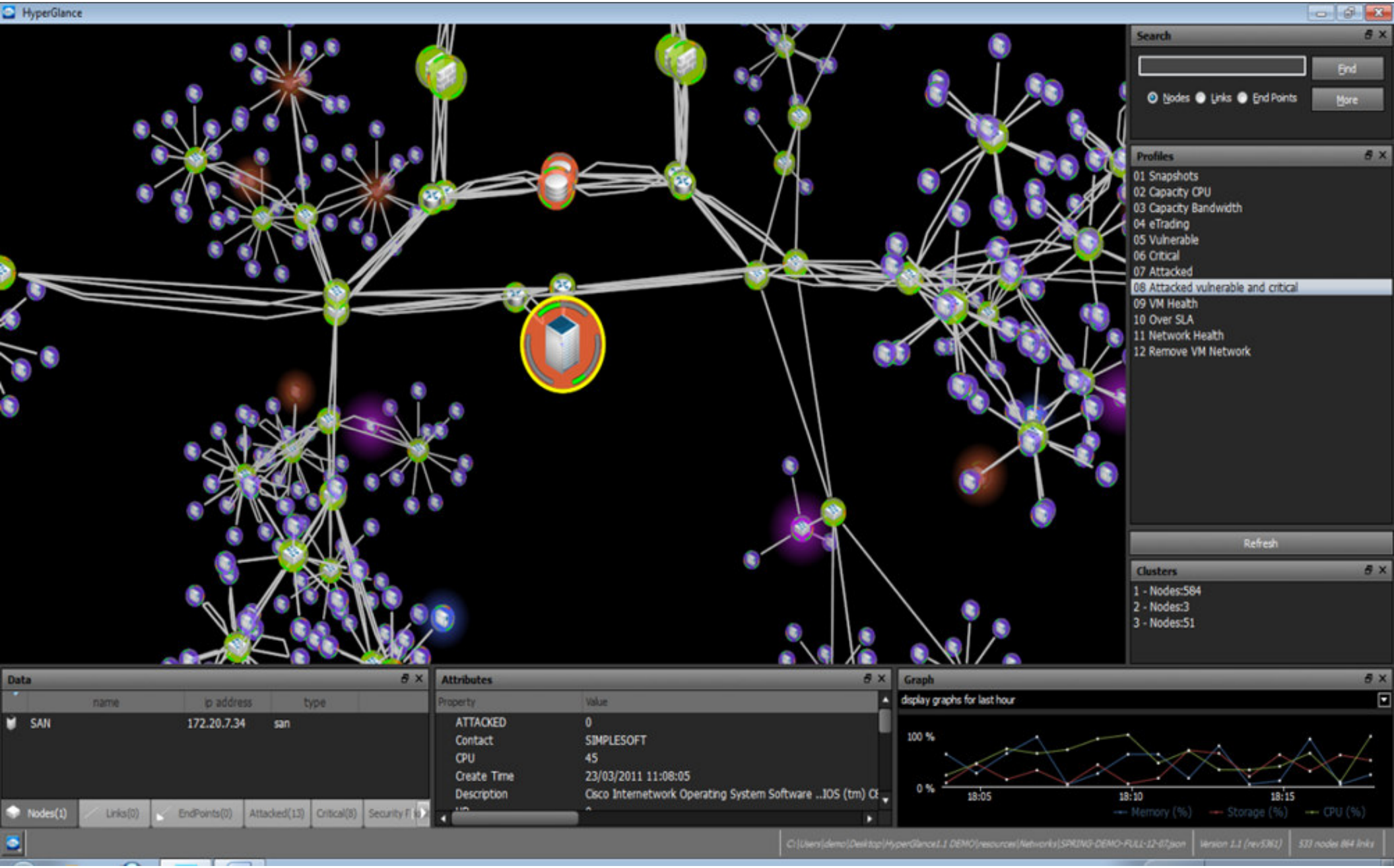
- Intelligent Network Design Toolkit -



IBM: Virtual Desktop for *Smart Business Architecture*



Smart 3D ICT Net Modelling: *Hyperglance*



Hyperglance Real-Time IT Modelling & Visualisation Software - Intergence.Com - *Cambridge, UK*

Relevance to Armenian Economy

- ***Skills:*** Armenia has outstanding legacy of key skills that are relevant to the development of Smart Solutions such as Mathematics, Computing & most Scientific Disciplines.

- ***Location:*** Armenia's Geographical Location mean that innovations & development of On-Line Business could provide a new route to Economic Growth during next 5 to 10 years.

- ***Innovation:*** Smart Systems provide an excellent innovation focus for new start-up Armenian Ventures in Technoparks. Target markets could include ICT, Healthcare, Energy, Environment, Education, Transportation & Finance/Banking,

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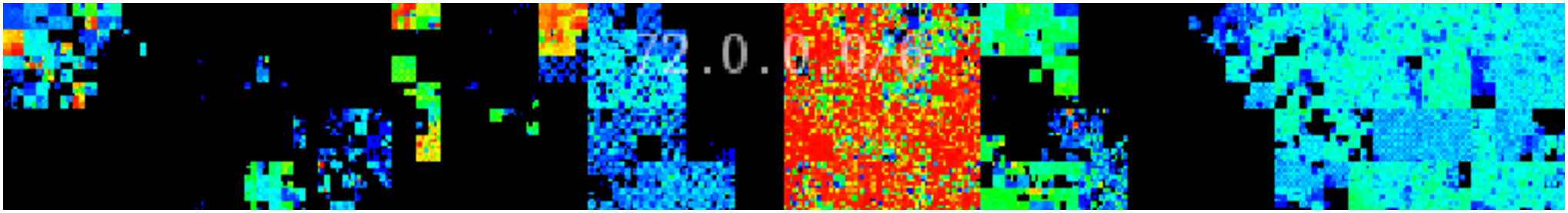
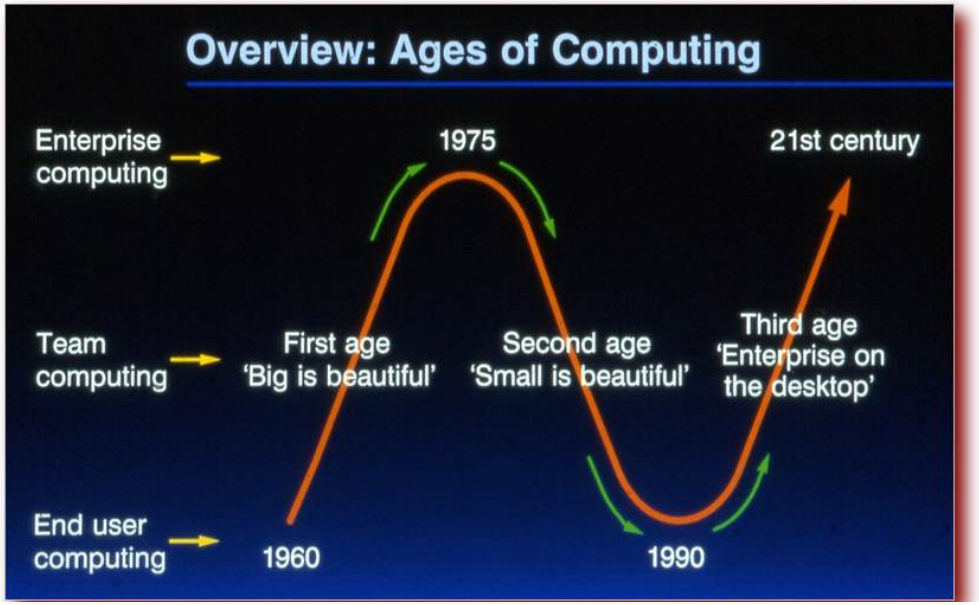
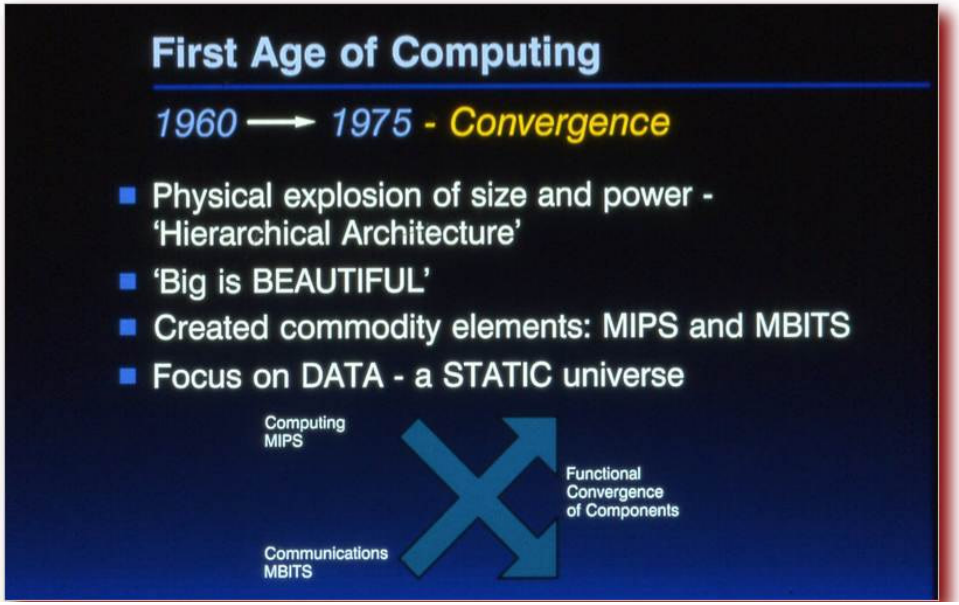


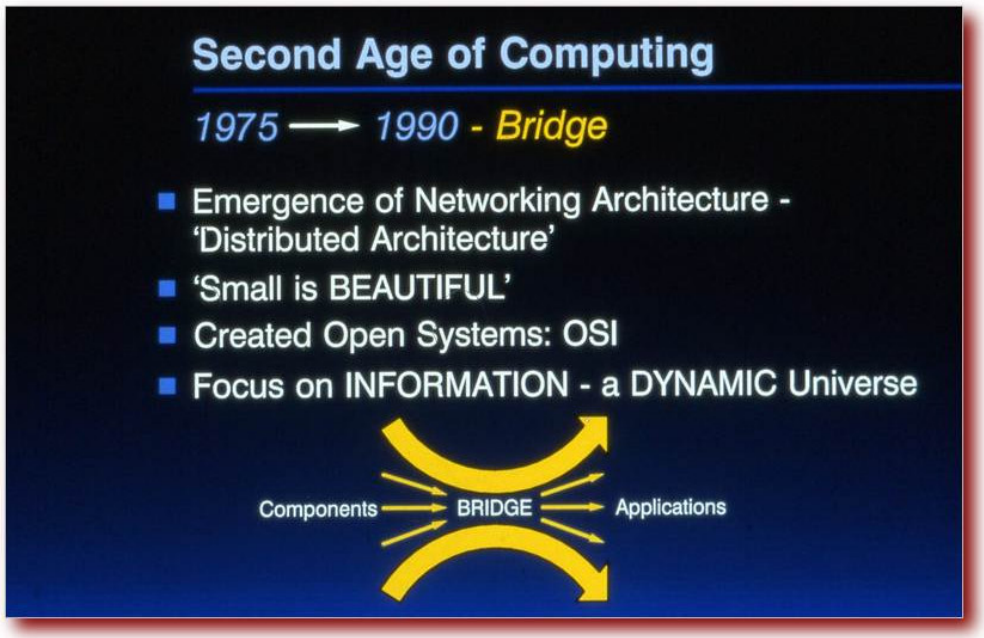
ICT Foundations for Smart Systems

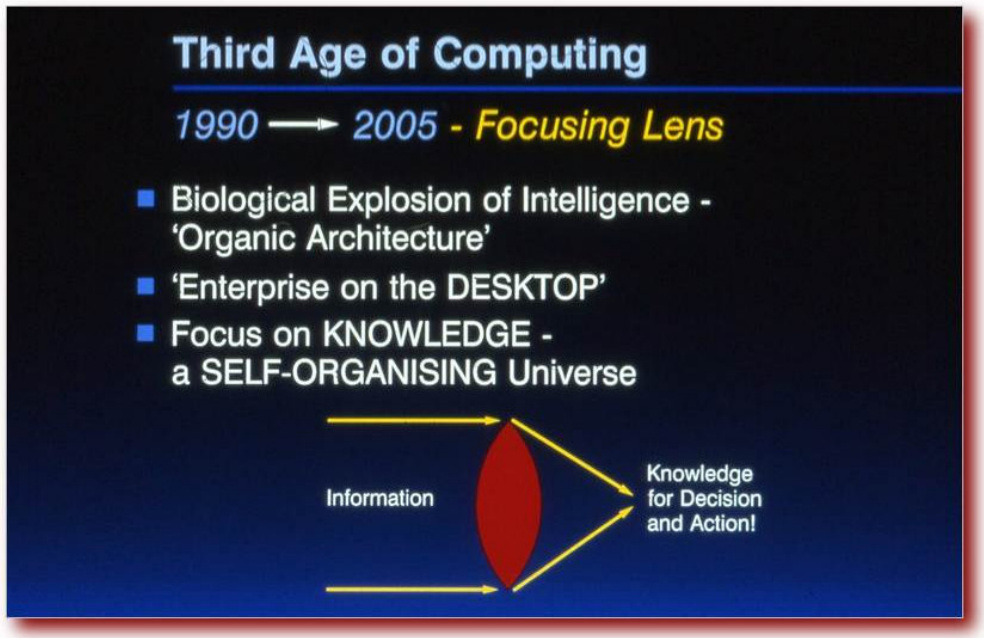
- Smart Systems require a wide diversity of functions & features just like "living organic cells". Advanced ICT now provides many existing and emerging smart options:
  - ***Networks:*** High-Speed Giga Byte Networking: Physical, Mobile & Wi-Fi
  - ***Virtualisation:*** Multi-Threaded Processors & System Virtualisation
  - ***Massive Storage:*** Internal, External & "Cloud" Storage, with Data Mining
  - ***Semantic Web:*** Led by W3C – "Smart Web" with linguistic understanding
  - ***Cybersecurity:*** Real-Time Security for O/S & Applications Software
  - ***Architecture :*** Scalable Architecture Solutions for Software Platform
  - ***Interface:*** Intelligent User Interface: Touch & Body Control
  - ***Standards:*** Conformance to International Standards (ISO/IEEE)
  - ***Location:*** Location Aware (GPS) & Environmental Sensors/Feedback
  - ***Immersive Media:*** Augmented Reality (AR) for Immersive Real/Virtual Worlds
  - ***Social Media & Search:*** Both are now generic global ICT service capabilities
  - ***Smart Mobile Media:*** At the heart of new Business Models & Architectures
- ***The Internet Protocol – TCP/IP (1975 – Vint Cerf & Robert Kahn) - is itself an adaptive networking protocol with dynamic routing, transmission and congestion control***

“Business Blueprint – Ages of Computing” - *1987*









Ages of Computing & Networking

- ***1960 to 1980 (Computing Big Bang – Physical Data):*** "Big is Beautiful" – Era of Massive Mainframe Computing with Minimal Networking

- ***1980 to 2000 (Network Architecture – Fluid Information):*** "Small is Beautiful" – Evolution of Networking (Ethernet, Token-Ring, and TCP/IP: '75 – Vint Cerf & Robert Kahn), PCs, Web1.0: '92-'94 & Mobile Phones

- ***2000 to 2020+ (Intelligent Systems – Cellular Knowledge):*** "Smart Solutions"- Web2.0, Social Media, Smart Phones & Intelligent Apps.

- ***Summary:*** The Evolution of ICT mirrors the Evolution of the Physical Universe, DNA/RNA Bio-Architecture, Intelligent Organisms & Life

Internet Society Conference – Prague – June ’94

….Panel of ICT Industry Experts including Cerf, Schmidt & Probert!

…..Opening Up the Commercial Exploitation of the Internet by Business & Governments

Basic ICT "Genes" for Smart Systems

- Intelligent Systems, either Artificial or Organic are based on just a few shared common principles that include:
  1) ***Space-Time Awareness:*** Location (GPS) & Real-Time Clocks
  2) ***Learning, Adaptation & Self-Organisation:*** Real-Time Intelligence
  3) ***Massive Memory & Storage:*** Local & Remote Cloud Storage
  4) ***Sustainable Security :*** Embedded Smart Security – *Everywhere!*
  5) ***Scalable Networked Architecture:*** Smart Architectures will need to scale in space & time from micro cells to macro solutions
  6) ***Decision Focus:*** "Knowledge Lens" for Data Mining & "Big Data" from Social Networks, Search & On-Line Commerce
  7) ***Systems Integration:*** Cyber and Physical Solutions & Operations

……Advanced ICT Solutions now provide ALL these "Genetic" Functions!

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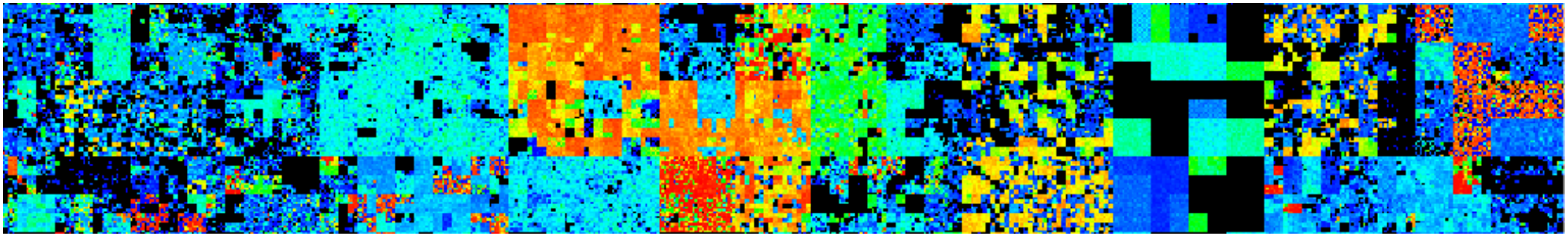


"How to Build Smart Solutions?"

- Smart Solutions all use combinations of the basic ICT "genes" shared with Intelligent Living Systems:

1) ***Hybrid Organisation:*** Hierarchical (Pyramid) & Organic (Networked)

2) ***Smart Decision Principles (D-Genes):*** Space, Time and Focus

3) ***Smart Learning Principles (L-Genes):*** Memory, Scaling & Adaptation

4) ***Smart Solutions & Business Architecture:*** Integration of the Decision + Learning "Genes", within a Secure & Resilient Systems Environment.

…21stC Focus upon Networking Business & Social Communities – "Social Web"

Hybrid Organisation: Hierarchical & Organic

- ***Transition*** from 19thC/20thC to 21stC Business & Governance requires fundamental re-structuring of operations:
  - ***19thC /20thC Industrial Organisations:*** Hierarchical Bureaucracies (Pyramids) to process data/information.
  - ***21stC Intelligent Organisations:*** Networked Peer-to-Peer Business & Agencies with data processed in cyber clouds
- ***Living Systems***, such as mammals, use hybrid organisation of their extended nervous system (brain & body) to optimise real-time environmental adaptation
- ***Smart Business Solutions*** will also require hybrid organisation to optimise real-time response and market adaptation

Smart Decision Principles - “D-Genes”

- ***Business Decisions*** require focusing & filtering of big data sources in Space-Time to create local knowledge. Hence a useful metaphor is the “Knowledge Lens”:
  - Smart Decision “Genes” = Space, Time and Information Focus
  - Conceptual “Knowledge Lens” can filter and focus information in “Space” from searching Big Data Sets to a Small focused Short-List
  - The “Knowledge Lens” can focus information & present over time, possibly as an stream of multi-media news or market intelligence

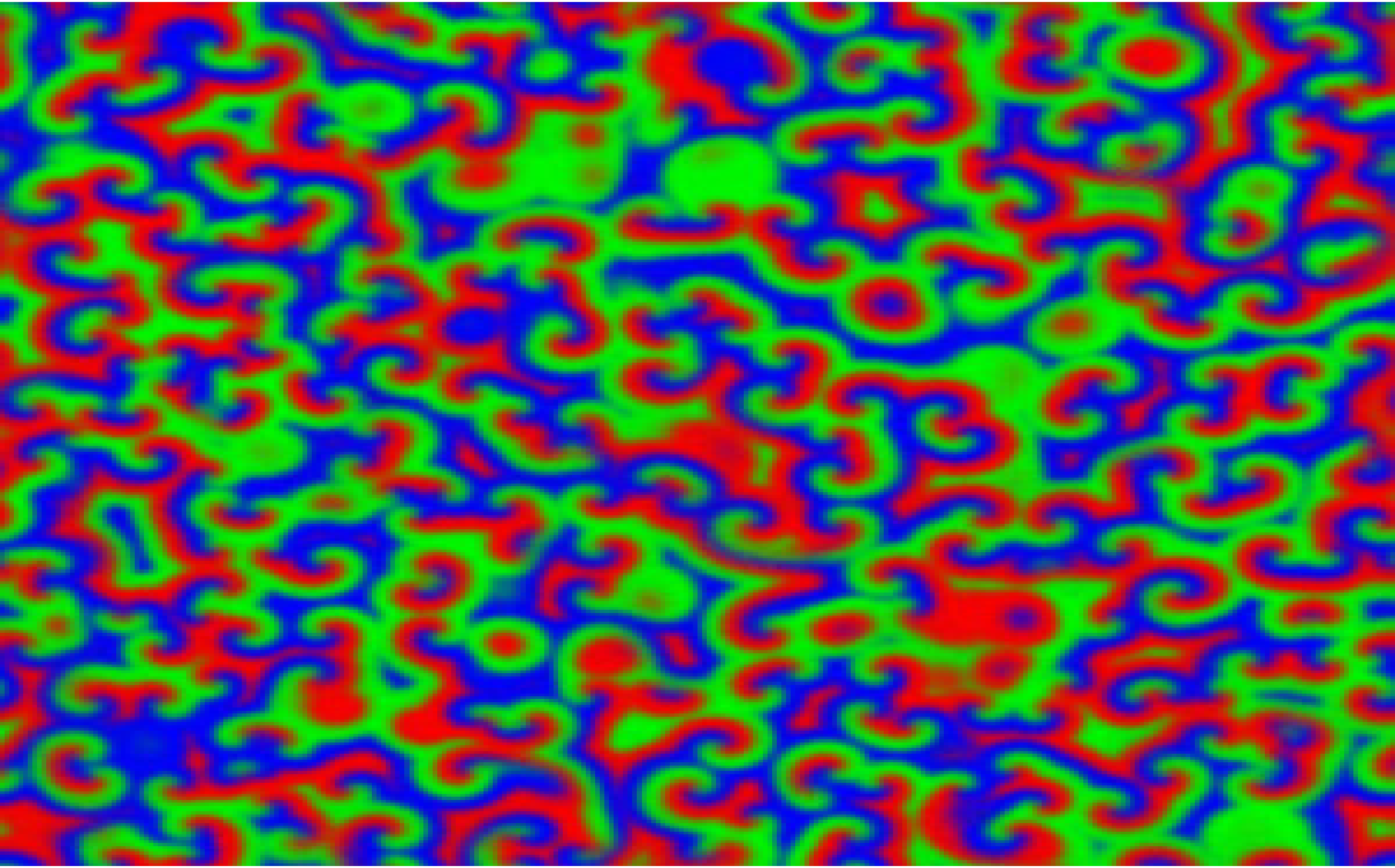
- ***“Knowledge Lens”:*** This concept can be a useful architectural principle in the design of smart business solutions & smart governance

Smart Learning Principles - “L-Genes”

- ***Smart Learning*** requires: Self-Organisation, Adaptation, Memory and Scalable Architecture. The Decision “Genes” are relatively traditional whilst these new Learning “Genes” lie at the heart of Smart Business.
  - ***Self-Organisation*** & Adaptation are essential principles of living systems and communities which include the well known self-organisation of insect roles in communities such as ants & bees.
  - ***Cellular Automata*** demonstrate relatively complex behaviour from simple mathematical rules, as in Conway’s “Game of Life”
  - ***Simple Dynamic Recursive Maps*** such as x => 4x(1-x) also result in complex chaotic behaviour & is found in real world insect populations
  - ***Scalable Architecture*** is also an essential feature of both plants & animal life, and the theory of Fractal Curves provides vivid examples.
- ***Current Trends:*** Research into Learning, Self-Organisation & Adaptation remains extremely active in both ICT R&D Labs & Academic Institutions

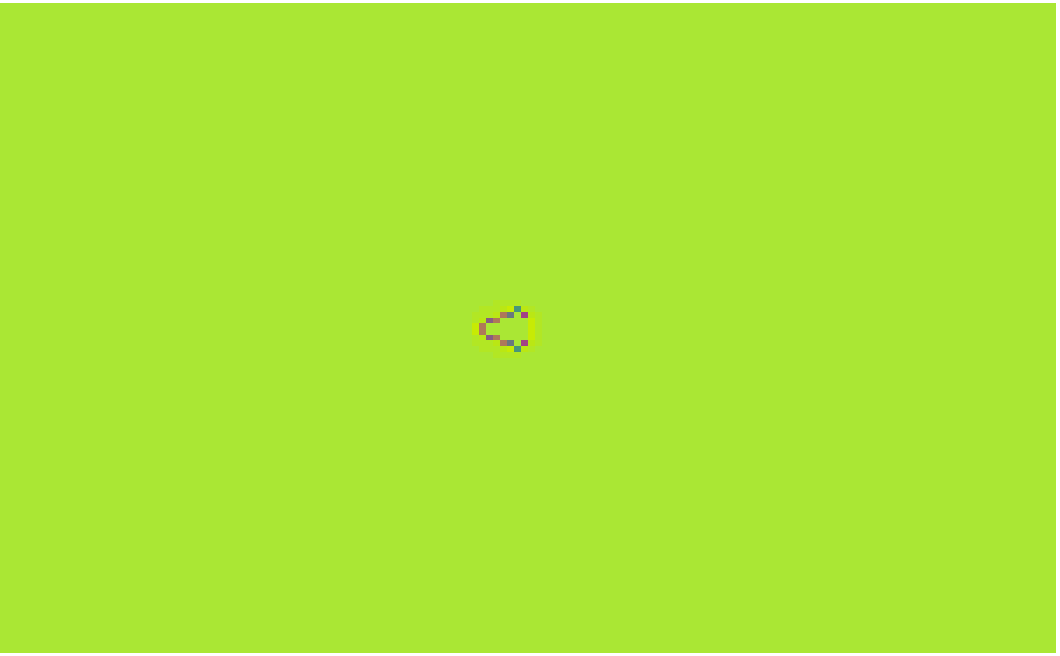
Non-Linear Chemical Oscillator:

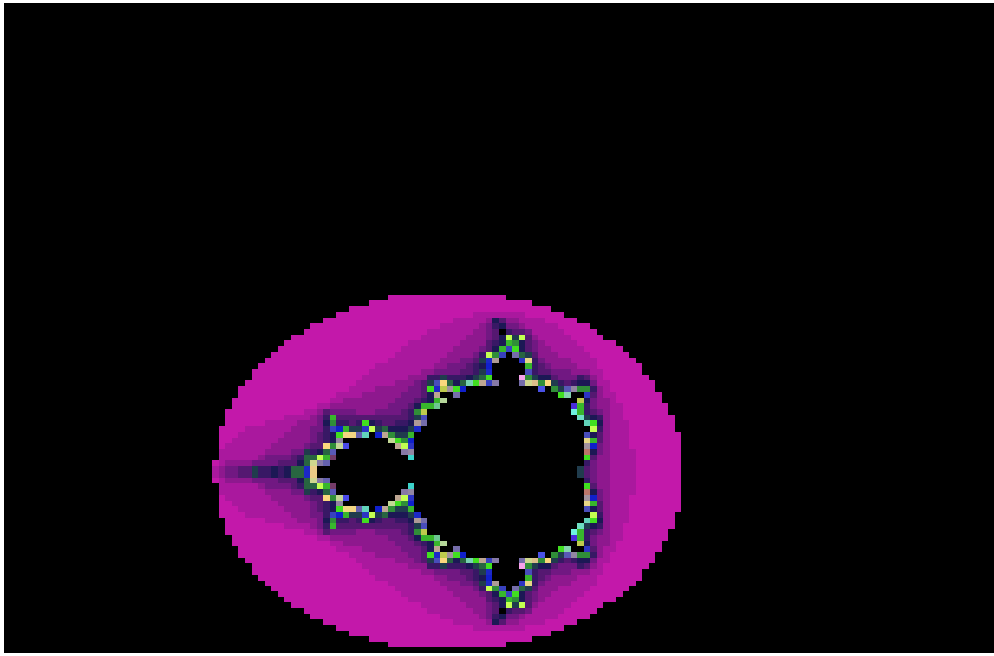
- Belousov–Zhabotinsky Reaction (BZ) -

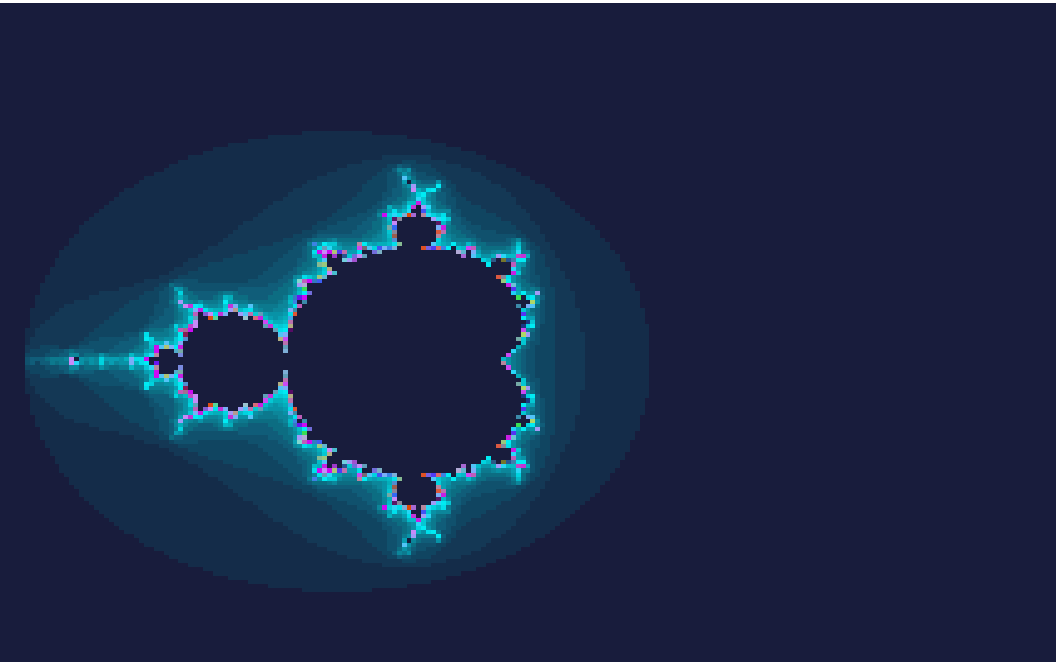


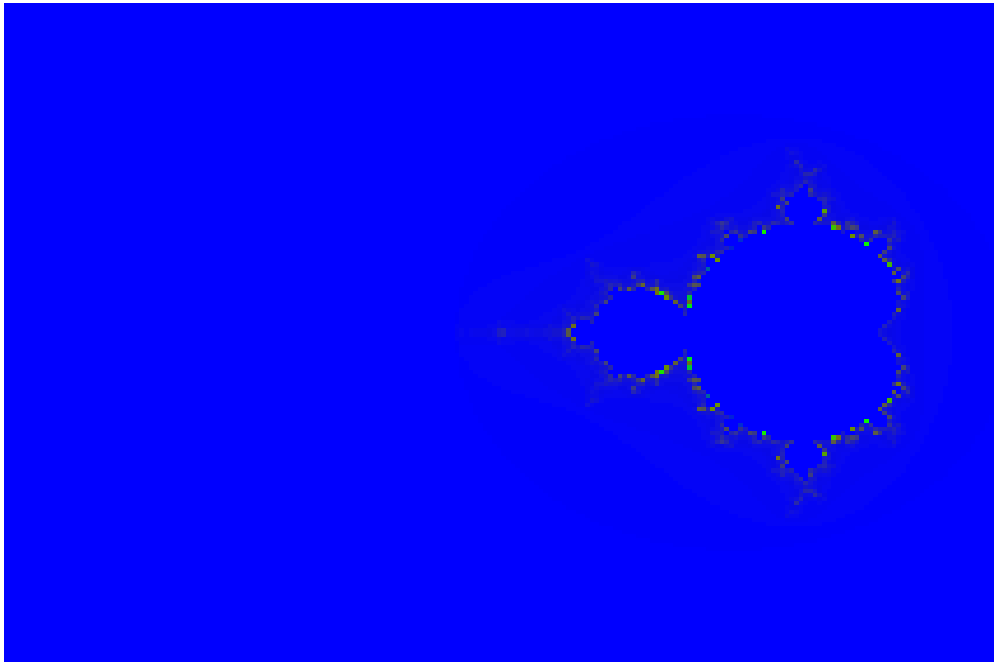
“Smart Scaling: Fractal Mandelbrot Set

….Fractal Scaling is frequently found in Nature



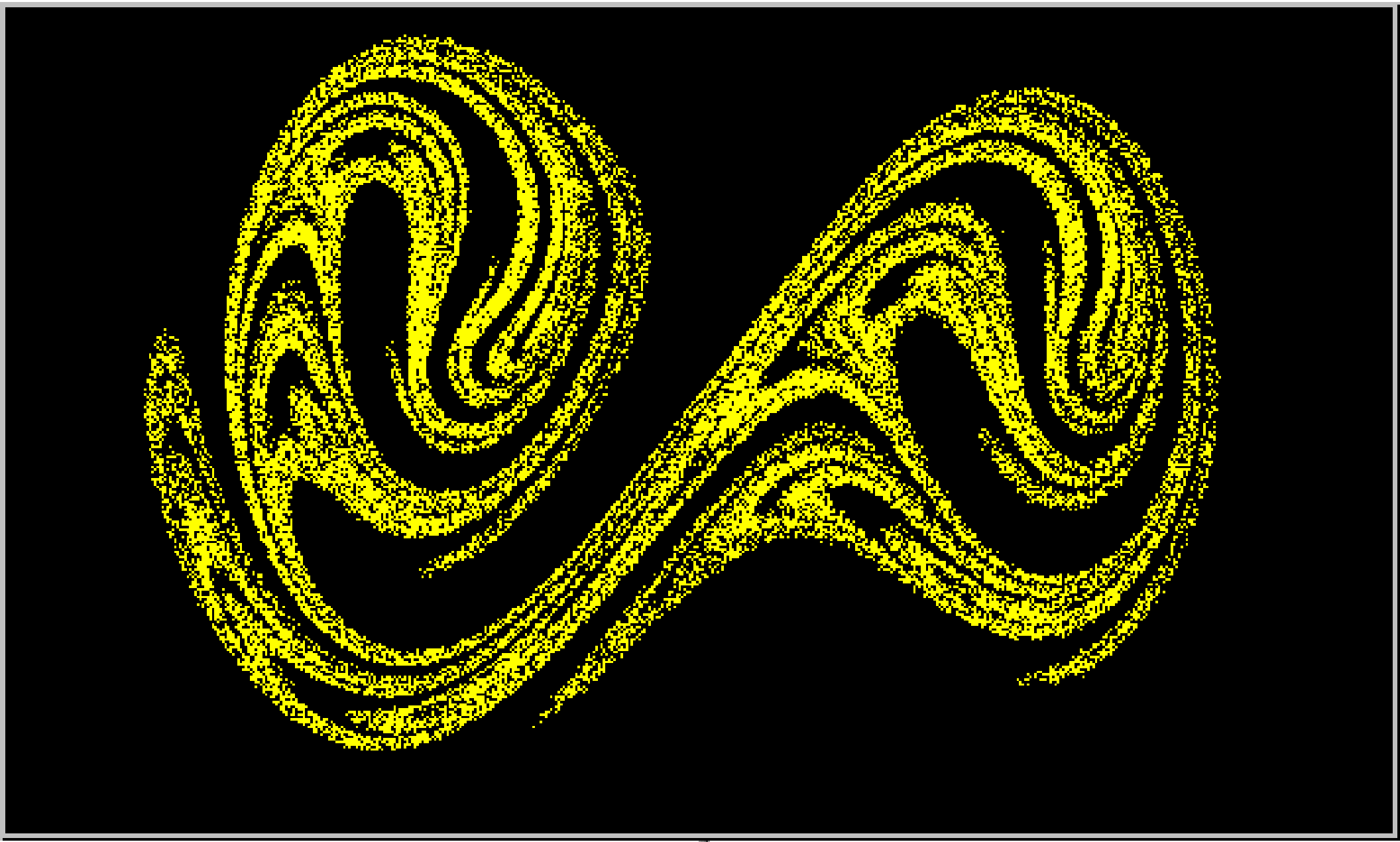






Chaotic Attractor: *Duffing Oscillator*

...."Chaos" is common in "Smart Systems and Communities"



Dynamic Duffing Equation: $\ddot{x} + \delta\dot{x} + \alpha x + \beta x^3 = \gamma\cos(\omega t)$ - Exhibits Chaotic Behaviour

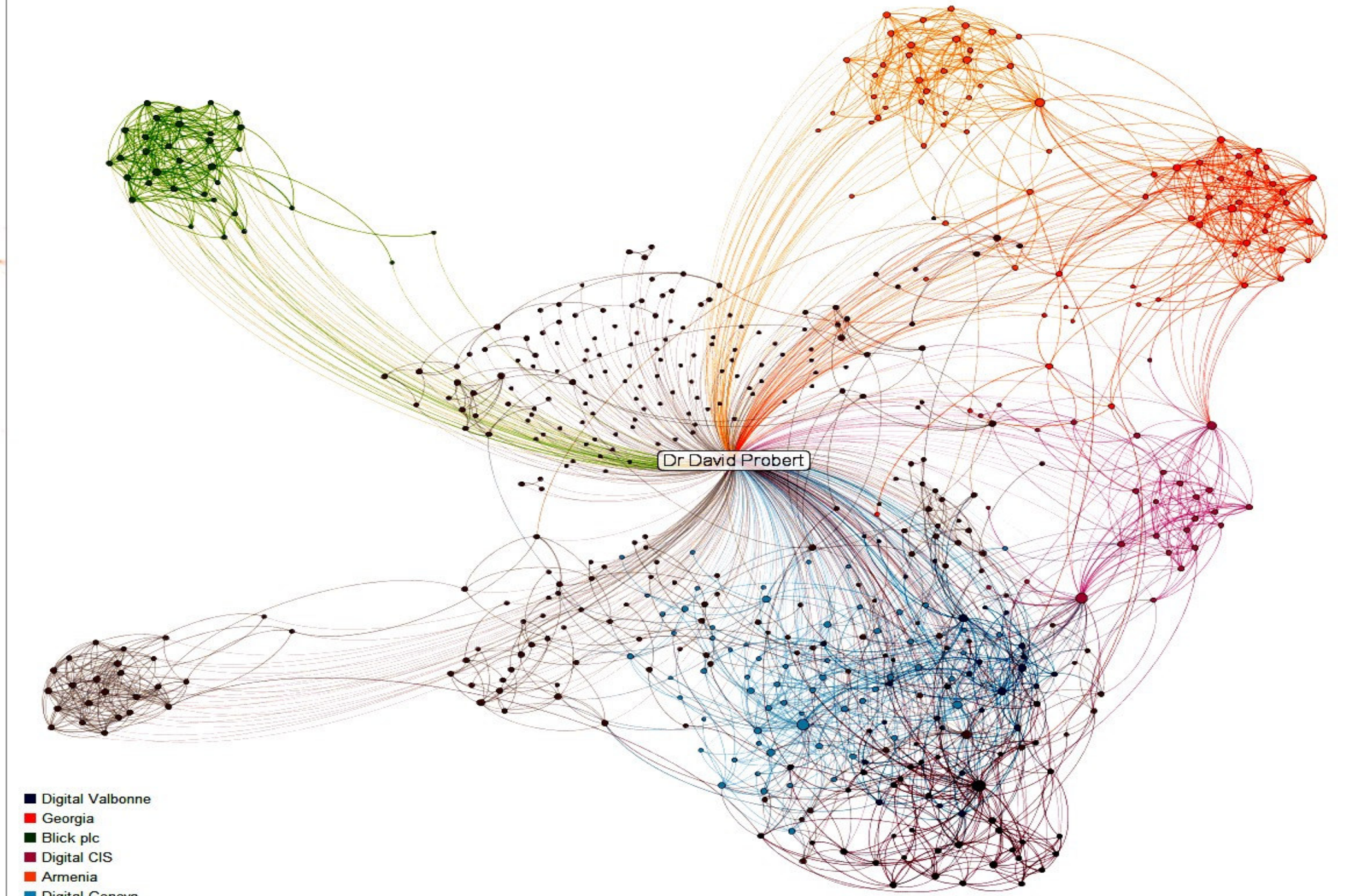
Smart Business Principles *in Action!*

- Successful Smart Business that deploy combination of "Smart Genes" & Smart Business Architectures:
  - ***Google:*** Massive Memory, Real-Time Search, Global Mapping & Imaging, User Tracking
  - ***eBay:*** Organic Architecture, Massive Auction Database, Scalability for Global Niche Markets, Real-Time Operations
  - ***Amazon:*** Massive Catalogue, Smart Warehouse Stocking & Delivery Logistics, Global Scalability, Local Partnerships
  - ***Facebook/Linkedin:*** Scalable from Individual to Community, Massive Commercial Database of Personal Interests & "Likes", Simple adaptable user interface & scalable architecture
  - ***Expedia:*** Global Network of Travel Partnerships (Hotels & Airlines), User Service Ranking, Cost Comparisons, Search Focus

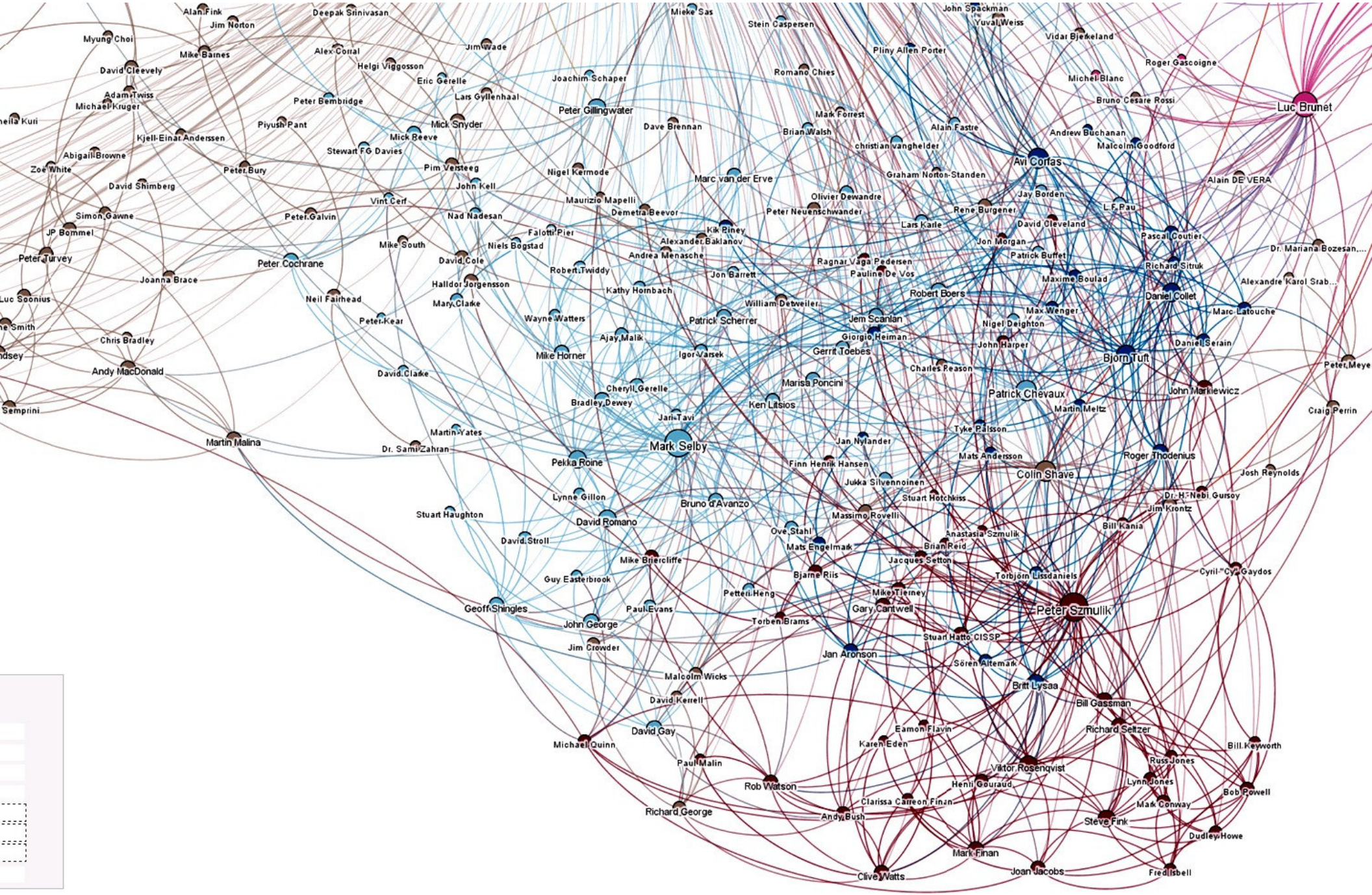
LinkedIn. Maps

Dr David Probert's Professional Network

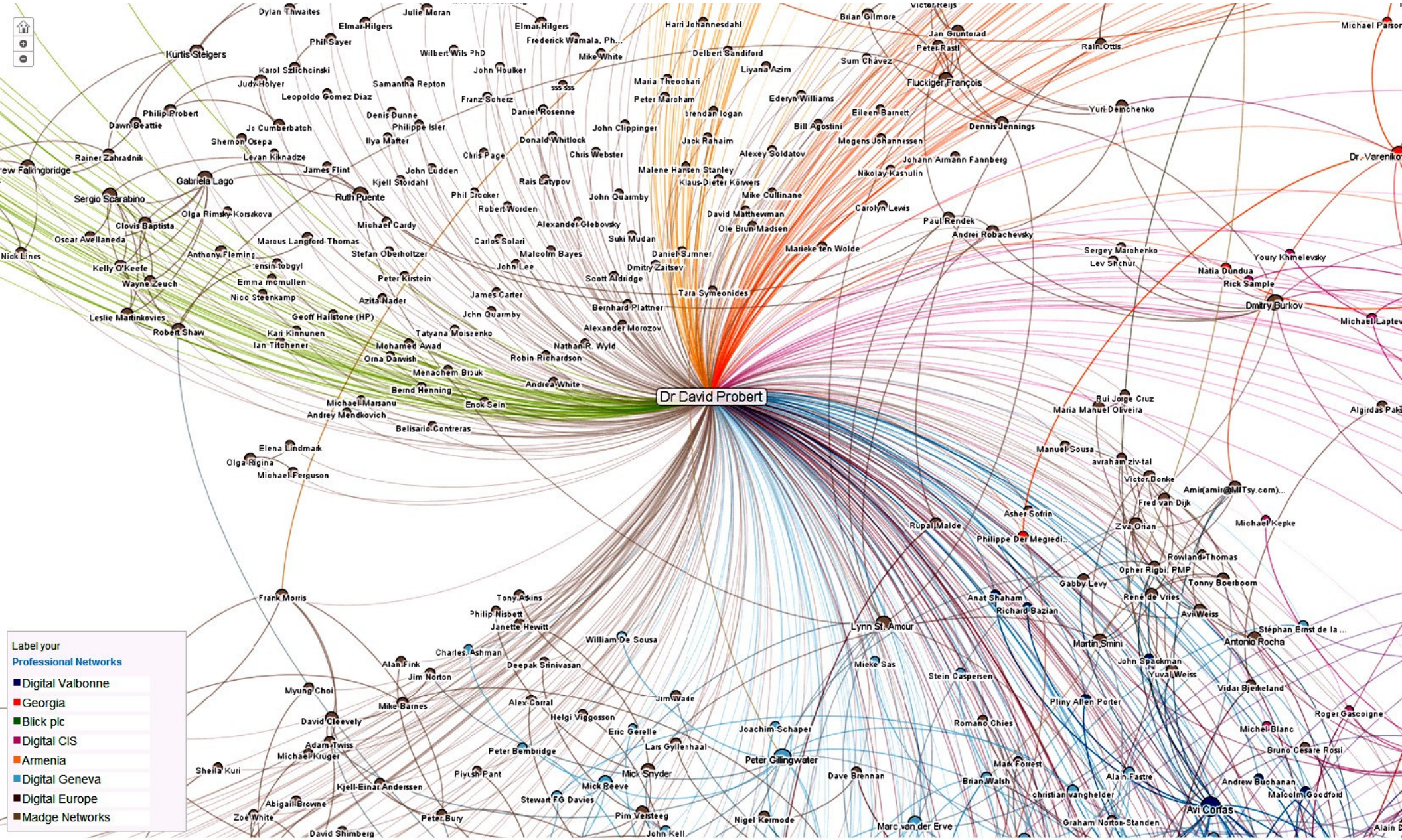
as of April 19, 2012



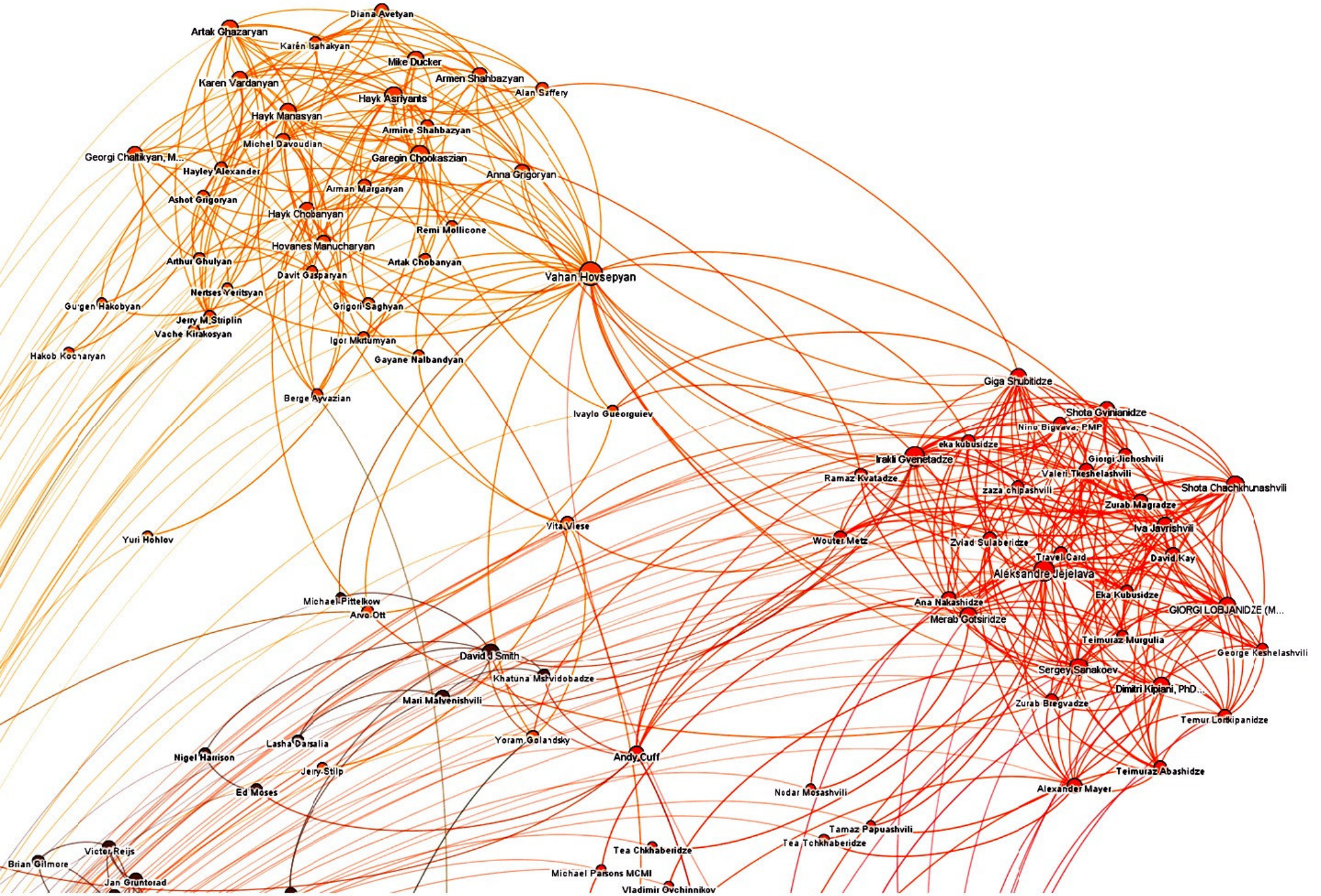
Mapping Social Media Networks: *LinkedIn*



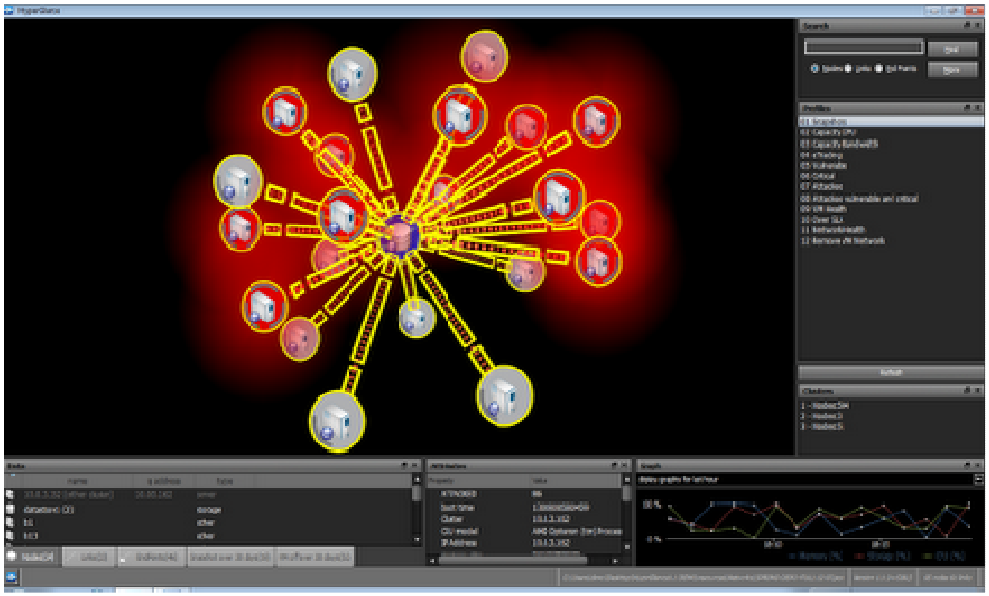
Mapping Social Media Networks

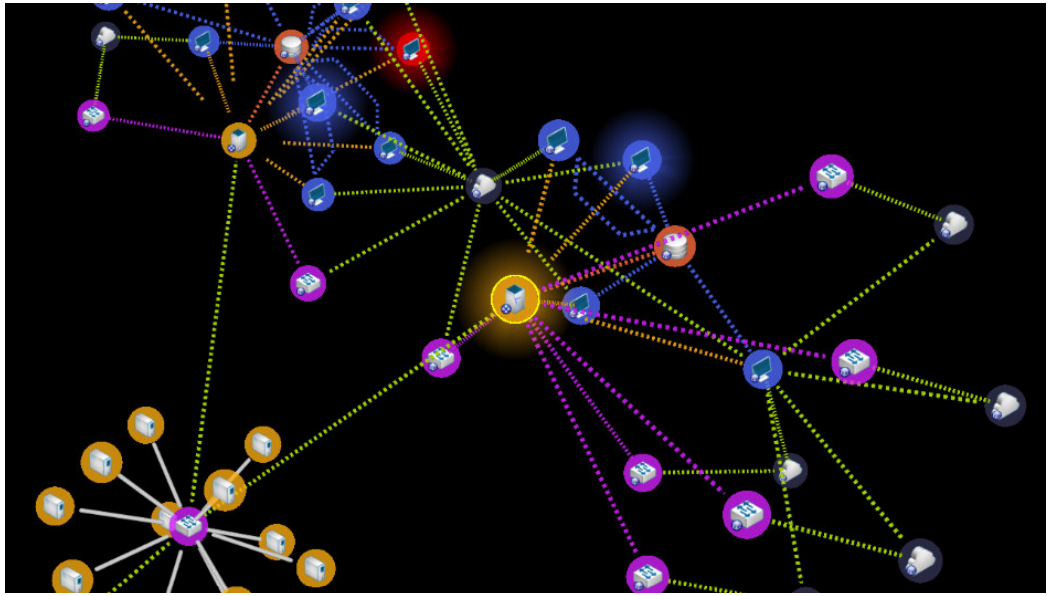


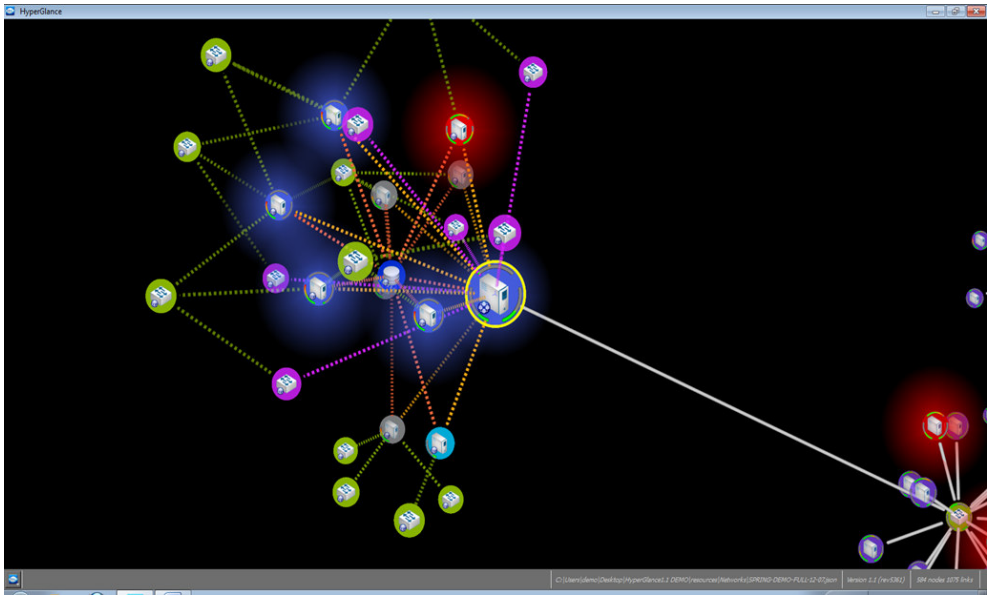
My *Linkedin* Social Media Map : *Armenia & Georgia*

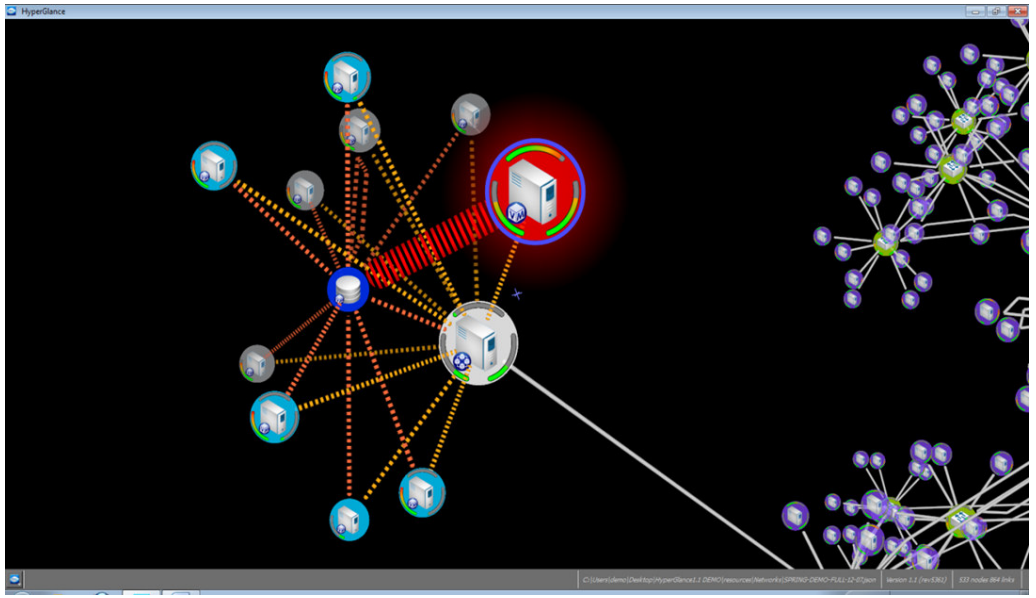


Smart 3D ICT Network Simulation: *Hyperglance*

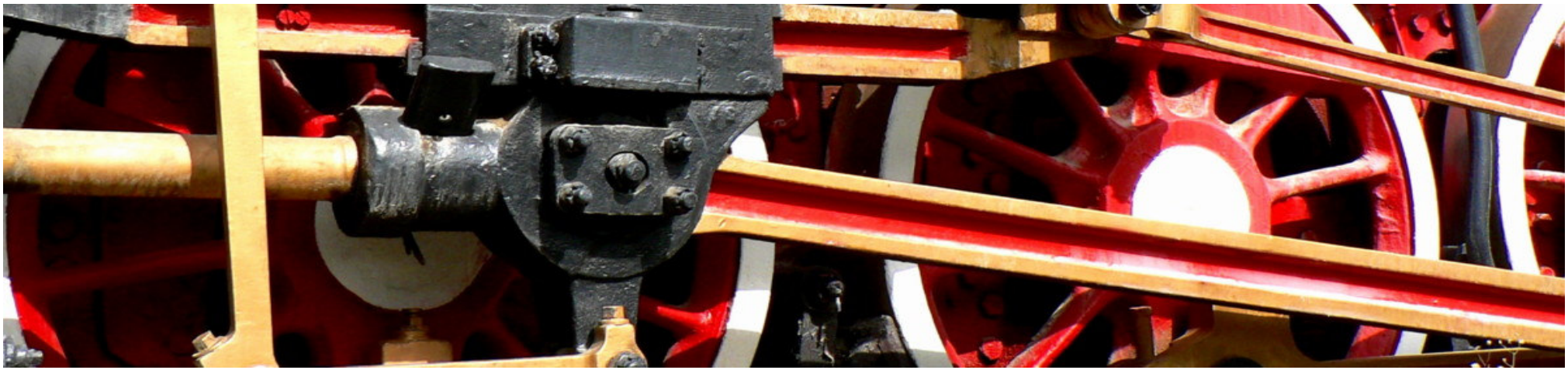








Defining Smart Solutions & Architectures



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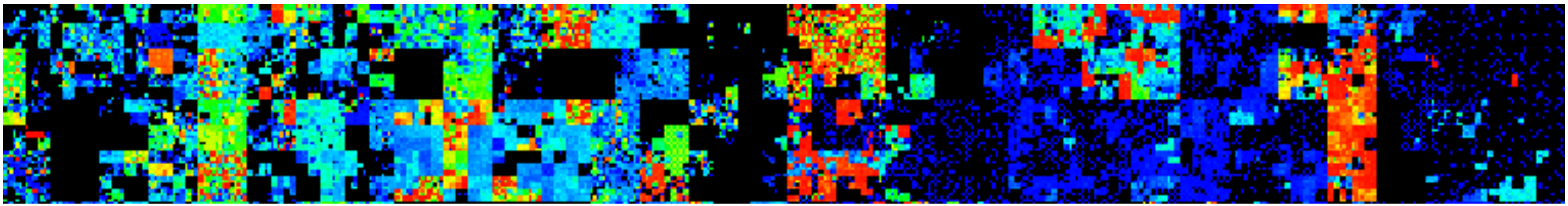
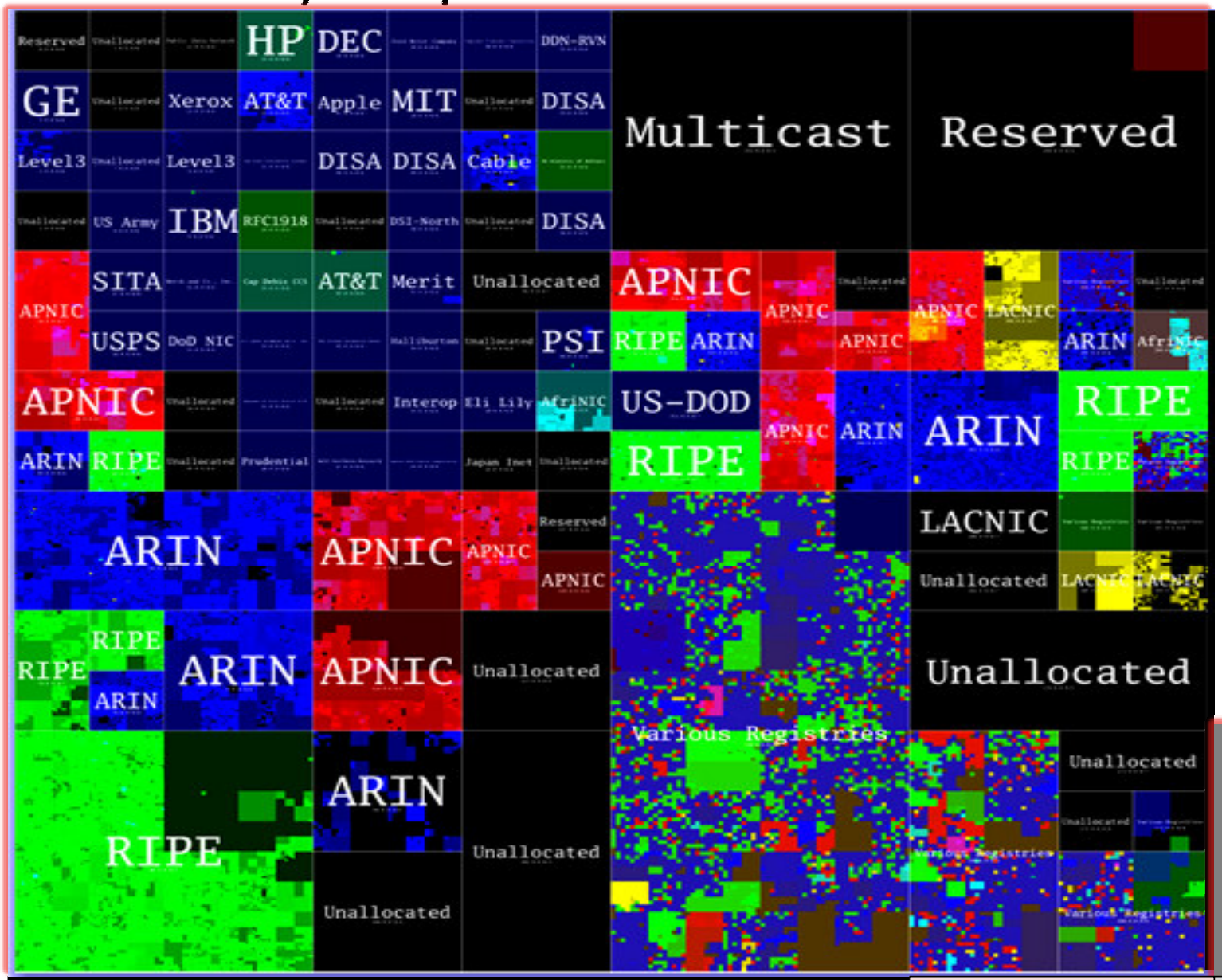


“Visualisation of Cyberspace”: *Global IP “WHOIS” Addresses*



-From 20thC Physical World To 21stC Cyberspace! -

Link: www.team-cymru.org

Key: Hilbert Space-Filling Curve Process

19thC- Mid 20thC Business & Governance Models

- From the ***18thC Industrial Revolution***, Business was Hierarchical & typically managed from a physical Board of Directors at HQ.
- ***Data Files*** were stored securely & secretly in closed storage.
- ***Multi-National Corporations*** became the "Financial Engines" and major employers of the 20thC International Business World
- ***Governance*** was typically also hierarchical, slow to adapt with high operational costs & large skill base of public sector workers

Summary: *19th/20thC Industrial Organisational Models were typically Fixed & Closed with Slow Adaptation & High Costs.*

21stC Smart Models for Business

- From 1980s onwards, many Enterprises started to deploy ICT networks, and to "flatten" their organisations from Hierarchical to Hybrid.
- Now in the 21stC Business is now starting to fully deploy more advanced ICT Solutions using the Smart Genetic Principles that we've just discussed:
  - ***Adaptation*** to Markets, New Product Features, Delivery Logistics, Minimise Stock Levels
  - ***Self-Organisation:*** Empower staff for Local Decisions with almost "Flat Organisation"
  - ***Scalable Architecture:*** Building Business as Cellular Organisation using High-Speed Nets
  - ***Space-Time Awareness:*** Utilise GPS Location and RFID Technologies to Track and Trace both Products, Staff and all moveable Business Assets to provide Real-Time Corporation
  - ***Memory & Storage:*** Low Cloud Storage Costs permit massive data mining on customer orders, profiles, search and buying behaviours. Already used by major international supermarket chains & global on-line players such as Amazon, eBay, Google.
  - ***Integration:*** Many Businesses need to integrate their on-line cyber & traditional physical operations to provide a integrated & coherent cyber-physical managed operation
  - ***Security & Resilience:*** Integrated adaptive management of cyber and physical security

Transition from Industrial to Smart

- Many Developed & Developing Nations & Regions are now navigating from Industrial to Smart Knowledge Economy. Possible Strategies to accelerate transition include:
  - National Government Programme to provide investment, support & training for innovation in Smart ICT & Smart Business
  - Support for Entrepreneurial Techno Parks & related Business Incubators that can provide new business skills and jobs for graduates
  - Public-Private Partnerships (PPP) between Government & Major ICT Enterprises (both National & International) to promote Smart Business Models as well as fund Smart Start-Up Ventures in target sectors.
  - Armenia should certainly consider leveraging its global Diaspora to promote “Smart Armenia” and encourage partnerships in markets such as ICT, Healthcare, Tourism & Finance using “Smart Models”

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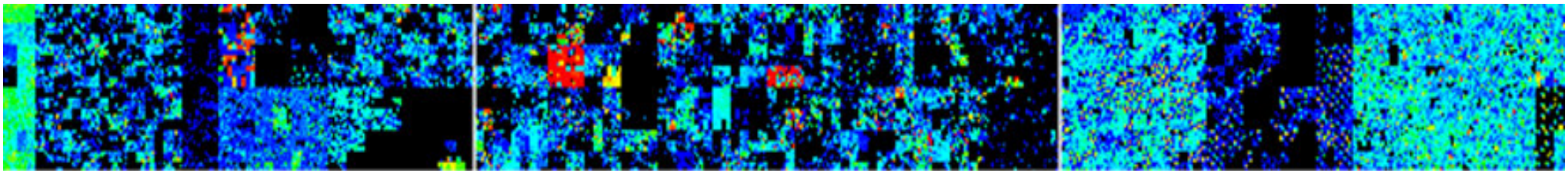

Open Business, Governance & Society

- Smart "Real-Time" Armenia is a 5 to 10 year mission that requires a well worked transition programme:
  - ***ICT Infrastructure:*** Smart adaptive systems require regional & national high speed wired, mobile & wireless networks
  - ***Legislation & Regulations:*** There is an international epidemic of cybercrime for which many countries have minimal legal & regulatory protection. New Laws & Regulations are essential!
  - ***Cybersecurity:*** Smart Systems require embedded security in every smart network node & business application
  - ***Economic Sector Focus:*** The Roadmap for Smart Armenia may be undertaken through step-by-step transition plans for critical national economic sectors – Finance, Energy, Health/Social, Defence, Education...

Economic & Competitive Benefits

- Armenia may leverage Smart ICT to boost its international presence & competitiveness:
  - ***Reach:*** Efficient & Expanded Global on-line market reach
  - ***Brand:*** Improved National Branding & Image*: "Smart Armenia"*
  - ***Innovation:*** Smart Platform for Product & Services Innovation
  - ***Jobs:*** Job Opportunities for New Generation of Graduates
  - ***Culture:*** Growth for Armenia's Creative, Cultural & Artistic Sector
  - ***Partner:*** Armenia becomes attractive partner for multi-nationals
  - ***Diaspora:*** *"Smart Diaspora"* may provide Armenia with significant business presence in more than 25 countries

New Architectures for the Smart Economy

- We can design new economic architectures using our Smart "Genes" & then customise sector by sector. We focus upon adaptation, scaling, massive data, & network transparency:
  - ***Education & Research:*** Transition from Monolithic to Niche Networks
  - ***HealthCare & Social Welfare:*** Telemedicine for towns & villages
  - ***Banking & Finance:*** "Real-Time" financial & commodity trading
  - ***Transportation:*** Smart Airports, Roads and Transportation Services
  - ***ICT Infrastructure:*** Launch 3G/4G Mobile Networks, and maximise Internet Services, Local Wireless Hubs & eGovernance across all Armenian Regions
  - ***National Security & Defence:*** Both for Physical Borders & CyberSpace
  - ***Travel & Tourism:*** Major opportunities for on-line bookings & marketing
  - ***Energy & Utilities:*** Secure Management of National Energy & Utility Grids

- *In "Master Class" Part 2 we'll explore the Smart Economy "In-Depth"*

Business Plan for “Smart Armenia”

- Smart Transition will realistically take 5 to 10 years so the multi-year strategic investment programme should be project managed by an appointed top-level *Government-Business* Team of Experts:
  - Key ICT Organisations include: UITE, EIF, ITDSC & EKENG/MinEconomy
  - Entrepreneurial Techno Parks (Yerevan & Gyumri) as Innovation Catalysts
  - National Smart Skill Training at Schools, Colleges and Universities
  - Promote National Awareness of “Smart Armenia” with Business & Citizens
  - “Smarten-Up” the ICT Infrastructure for every town, village & community
  - Promote Business Partnerships with Armenia as Regional “Smart Hub”
- *Investment Funding from combination of “Foreign Direct Investment” and National Investment by Government, Banks & Major Enterprises.*

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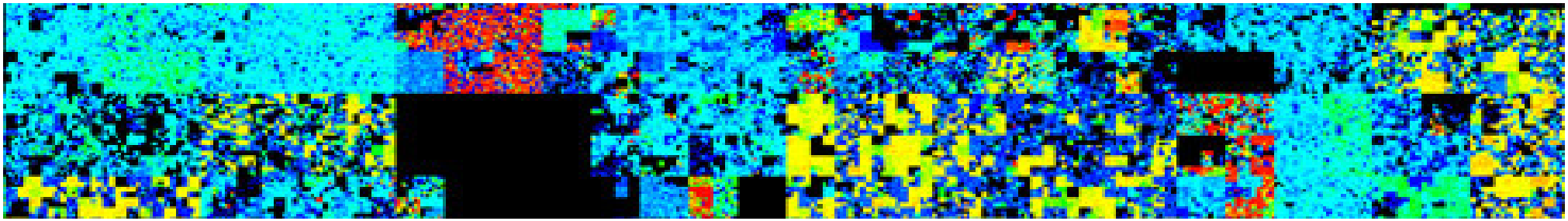


Smart Solutions for Economic Sectors

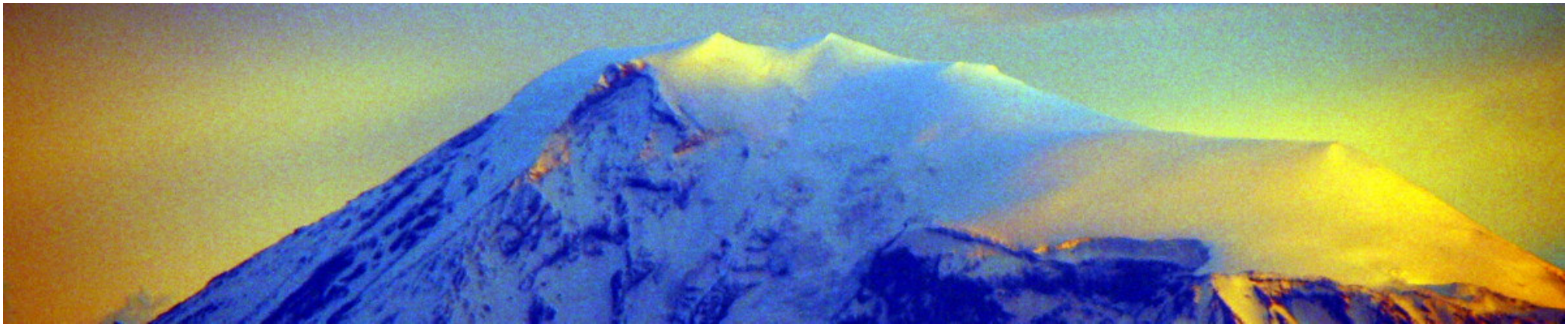
- During the coming 10 Years, every *Traditional* Economic Sector will eventually transition from "20thC Industrial" to a "21stC Intelligent" Sector!...

  …..Just a few examples:

  - ***Smart Agriculture:*** Promote increased farming efficiency for both crops and animals through on-line knowledge networks. Information on crop & animal feeds, pest control, climate forecasts, markets & prices.
  - ***Smart Arts & Culture:*** Promote Armenian Artists from Theatre, Opera, Films, Jazz/Blues to both the Diaspora as well as non-Armenian Audience
  - ***Smart Retail/Distribution:*** On-Line Shopping and Commerce, particularly for Armenian Products such as ICT Software, Pharmaceuticals, & Jewellery.
  - ***Smart Cities:*** Integrated Management of Physical & Cyber Infrastructure including Energy, Environment, Transportation, Health & Social Welfare, Homes, Offices, Schools, Police and City Security.

- In "Master Class" Part 2 we'll discuss more concrete ways to implement Smart "Best Practice" for Economic Growth & boosted National Competitiveness….

Defining Smart Solutions & Architectures



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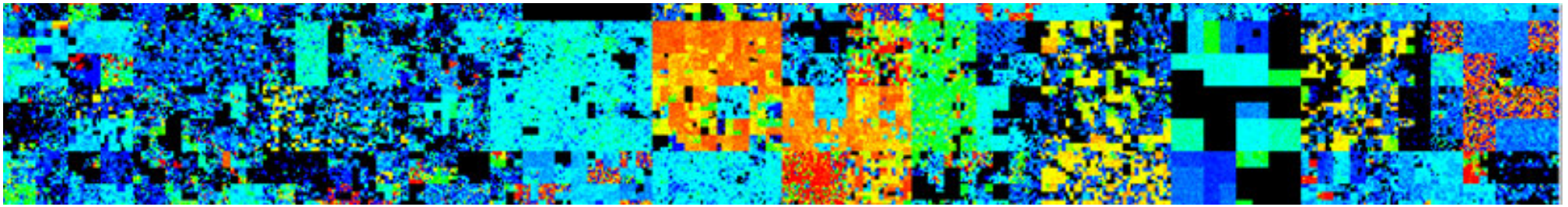

- Smart Sustainable Security in the Wild! -

The Sociable Weaver Bird

"World's largest Bird Nests"

*** Southern Africa ***

- Secure Living Community
- Self-Organising Architecture
- Fully scalable for long term growth
- Supports 250+ Weaver Birds
- Real-Time Disaster Alert System
- Sustainable in Semi-Desert Steppe
- Robust against "Enemy Risks" such as Eagles, Vultures & Snakes

...all the features of a 21st C-"Cyber Defence Centre"–including Disaster Recovery & Business Continuity!

Cyber: Integrated Command & Control

- ***Security Operations Command Centre for Global Security Solutions Enterprise***

Physical: Integrated CCTV Surveillance

- ***CCTV Command and Control Operations Centre for Large UK City***

Smart Security: *Integrating Cyber & Physical*

- ***Dual Operations:*** Security is often managed under separate management for physical building & personnel security and IT Computer & Network security. In addition, the risks are continuously evolving so an adaptive model is essential!

- ***ISO Security Standards:*** Smart Sustainable Security requires operational linkages & integration between cyber and physical security in order to meet current ISO 27xxx Security Standards, and to minimise risk of cyber attacks.

  - ***Physical Security:*** Buildings, People, National Borders, Government Ministries

  - ***Cybersecurity:*** Computers, Storage, Networks, Applications, Mobile Devices

- *"Smart Sustainable Security" will be discussed "In-Depth" later within a dedicated DigiTec Presentation that explores security risks & solutions.*

Transition from 20thC to 21stC Smart Security

- **Cybersecurity 2012-2022:**
  - Every country in the world will need to transition from the traditional 20thC culture & policy of massive physical defence to the connected "neural" 21stC world of in-depth intelligent & integrated cyber defence solutions
- **National Boundaries:**
  - Traditional physical defence and geographical boundaries are still strategic national assets , but they need to be augmented through integrated cyber defence organisations & assets.
- **Critical National Information Infrastructure:**
  - 21stC national economies function electronically, & yet they are poorly defended in cyberspace, and very often open to criminal & political attacks
- **Multi-Dimensional Cyber Defence:**
  - Armenia needs to audit its critical infrastructure – government, banks, telecommunications, energy, & transport – and to upgrade to international cybersecurity standards based upon "best practice" (ISO/IEC)

Smart Security: *National Cybersecurity Case Studies*

- ***UK Government:*** Cybersecurity Strategy for the UK – Safety, Security & Resilience in Cyberspace (UK Office of Cybersecurity – June 2009)
- ***US Government:*** Cyberspace Policy Review – Assuring a Trusted and Resilient Information and Communications Infrastructure – May 2009
- ***Canada:*** Canadian Cyber Incident Response Centre (CCIRC) – Integrated within the Strategic Government Operations Centre (GOC)
- ***Australia:*** Australian Cybersecurity Policy and Co-ordination Committee (CSPC – Nov 2009), within the Attorney-General's Government Dept
- ***Malaysia:*** "Cybersecurity Malaysia" – Mosti : Ministry of Science, Technology & Innovation, and includes the MyCERT & Training Centre
- ***Singapore:*** Cybersecurity Awareness Alliance & the IDA Security Masterplan (Sept 2009) -Singapore Infocomm Technology Security Authority - SITSA
- ***South Korea:*** Korea Internet and Security Agency (KISA – July 2009)
- ***Latin America :*** CITEL/OAS has developed regional cybersecurity strategy
- ***European Union:*** ENISA – European Network and Information Security Agency (September 2005) tackles all aspects of cybersecurity & cybercrime for the EU & Beyond

Integrated Cyber & Physical Security: *"The Shopping List"*

1) ***National Cybersecurity Agency*:** Establishment of a CERT & National Government Cybersecurity Agency within the Government Ministries
2) ***CIIP:*** Long Term Critical Information Infrastructure Protection (CIIP)
3) ***System Upgrades*:** Technical Infrastructure Upgrades including Hardware, Software, Databases, Secure Network Links, Biometrics & RFID
4) ***Back-Up*:** Disaster Recovery, Business Continuity and Back-Up Systems
5) ***Physical* :** Physical Security Applications – CCTV, Alarms, Control Centre
6) ***Awareness Campaign*:** Government Campaign for cybersecurity awareness
7) ***Training*:** National Cybersecurity Skills & Professional Training Programme
8) ***Encryption*:** National User & Systems PKI Authentication Programme
9) ***Laws:*** Costs for Drafting and Enforcing Cyber Laws. Policies & Regulations

…….It is important to develop an in-depth economic "cost-benefit" analysis and Business Case in order to evaluate the "Return on Investment" for Smart Security

Smart Security Benefits: *Armenian Business & Government*

- Improved cybersecurity will provide significant benefits to the Armenian Government, Business & Critical National Service Sectors including:

  - ***eGovernment:*** Fully secure & cost effective delivery of on-line services to both citizens and businesses, such as taxes & customs, social welfare, civil & land registries, passports & driving licences
  - ***eDefence:*** Early warning, alerts and defences against cyber attacks through national CERT (Computer Emergency Response Centre)
  - ***Cybercrime:*** Investigate, Digital Forensics and Prosecution of cybercrimes such ID & Financial Theft, "Computer Misuse, Laundering, On-Line Drug Trafficking & Pornographic Materials
  - ***Cyberterrorism:*** Ability to assess, predict and prevent potential major cyber terrorist attacks, and to minimise damage during events
  - ***Power & Water Utilities:*** Prevent malicious damage to SCADA control systems
  - ***Telecommunications:*** Top security of government communications with alternative routings, encryption & protection against cyber attack

Smart Sustainable Security: *Armenia's Coat of Arms*

Cyber World = Eagle
(Artaxiad & Arsacid)

Physical World = Lion
(Bagratuni & Rubenid)

Five Vital Symbols:

Feather Pen (**Culture & Intelligence**), Broken Chain (**Freedom & Independence**),
Wheat Flower (**Industry**), Sword (**Power & Strength**), Tri-Coloured Ribbon (**Armenian Flag**),

Smart Security = *Eagle AND Lion Jointly Protecting Armenia!*

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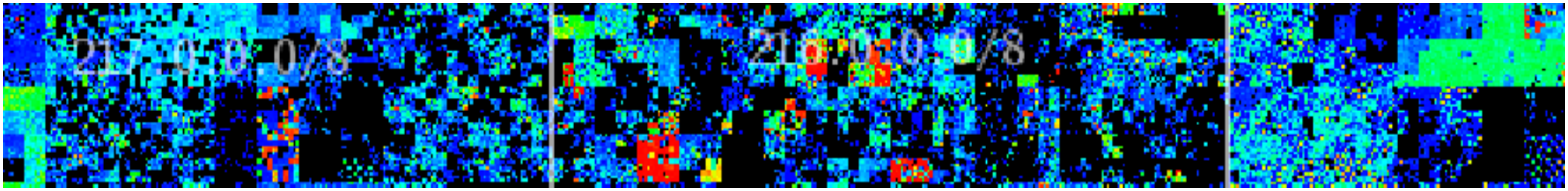

Some Principles of Smart Governance

- Smart Governance requires a regional & national managed ICT Infrastructure supporting a diverse range of eGovernment Services:
  1) ***Open Networks:*** Smart Governance is focused & driven largely by Business & Citizens through on-line portals linking Government Ministries & Agencies.
  2) ***Legislation & Regulations:*** New Laws & Regulations are usually required to enable on-line services to be implemented so that all eGov related transactions, documents, IDs and electronic signatures have full legal status
  3) ***Public-Private Partnerships:*** Accelerated Implementation of Smart Governance can be achieved through Public-Private Partnerships. These bring in both investment and advanced ICT technical engineering skills to Armenia.
  4) ***Transparency:*** Smart Governance has benefit of more transparent operations, although this may impact on security & privacy unless new policies are adopted
  5) ***Real-Time Events:*** Smart "Real-Time" Government Operations will typically become significantly more efficient, requiring reduced annual budgets & staff
  6) ***Distributed Organisation:*** Smart ICT Networks make it easier and more practical to distribute certain Government Tasks & Operations from Yerevan to Regional Cities
  7) ***Phased Implementation:*** Transition to Smart Governance is a Multi-Year Programme

Top Smart Governance Transition Issues

- Transition from Traditional to Smart Governance will give rise to a range of issues:
  - Moving from Hierarchical Management to Matrix Management
  - Tackling the Impact of Transparency for Personnel Privacy & Data
  - Reducing the Risk of Cybercrime & Data Theft from On-Line Services
  - Implementation and Conformance to International ISO Standards
  - Retraining staff for new service related jobs in the Smart Economy
  - New styles of government relationships with regional partners
  - Increased power & influence from “on-line” citizens using social media

- *In summary, all these transition issues can be resolved within a framework of an Armenian RoadMap for Smart Governance*

Organisation, Architectures & Standards

- The Top Preliminary Task in the Phased Transition to Smart Governance & Smart Economy is the appointment of the leadership organisation that will set the Mission and also:
  - ***ICT Networks:*** Responsibility for the National ICT Infrastructure & Services
  - ***Architecture:*** Organisational Architecture for Government & Critical Sectors
  - ***Laws:*** Legislation and Regulations for On-Line Commerce and Security
  - ***Partners:*** Negotiations with national & international investment partners
  - ***PPP:*** Prioritise Sectors for Public-Private Partnerships
  - ***Skills:*** Encourage Smart Innovation Skills in Techno Parks & Incubators
  - ***Standards:*** Publish Standards for Smart Services and Monitor Compliance
  - ***PR:*** Launch National PR Campaign to promote awareness of Smart Governance

Armenia has already launched the transition to Smart Governance, but further actions remain to be implemented during the coming 5 to 10 years.

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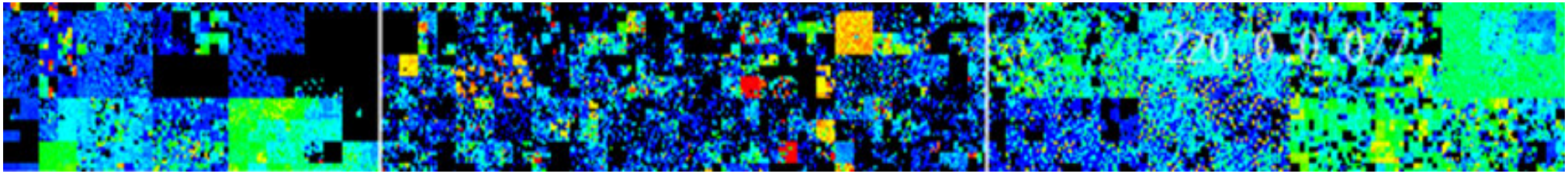

From “Smart Theory” to “Best Practice”

- The Basic Theory & Principles of “Smart Solutions & Architectures” will be researched for years to come!
  - This “Master Class” provides an overview of current knowledge & trends in research into “Smart Solutions & Business Architectures”
  - “Best Practice” in “Smart Solutions” implementation can be found in developed nations such as those in Western Europe, North America & SE Asia
  - Developing Nations such as Armenia may use “Smart Solutions” to leapfrog larger & richer nations since they have smaller legacy organisations & may quickly invest & implement “state of the art” 21stC ICT infrastructure!
- *In summary, Armenia is well positioned to leverage advanced ICT solutions in order to boost economic GDP & competitiveness!*

Action Plan: "21stC Smart Armenia"

- ***Smart Programme:*** Following DigiTec 2012, Armenia should establish on-going programme to develop Smart ICT Skills, Solutions & Business. Organisations leading the initiative may include UITE, ITDSC, EIF, EKENG and of course the key Armenian Government Ministries & Agencies.
- ***eGovernance:*** "21stC Smart Armenia" is a national extension of the existing eGovernance Programmes managed through MinEconomy
- ***Smart Trade Hub:*** Armenia may consider promoting itself as a natural Regional/International Hub for Smart Trade & Services: Russia (North), Middle East (South), Europe (West), Central Asia & China (East)
- ***Innovation & Incubation:*** Significant Competitive Advantage may be derived from the creation of new ventures that develop focused "Smart Services" for market sectors such as Healthcare, Energy and Transportation

In Part 2 we discuss specific ways in which economic growth can be boosted through the development of Smart Solutions targeted sector-by-sector….

Smart Solutions & Architectures”

DigiTec Business Forum – Yerevan, Armenia

Thank-You!...

Master Class Materials & Slides :

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Master Class Materials & Slides: *www.Valentina.net/DigiTec2012/*

Thank you for your time!

Professional Profile - *Dr David E. Probert*

- ***Computer Integrated Telephony (CIT)*** – Established and led British Telecom's £25M EIGER Project during the mid-1980s' to integrate computers with telephone switches (PABX's). This resulted in the successful development and launch of CIT software applications for telesales & telemarketing

- ***Blueprint for Business Communities*** – Visionary Programme for Digital Equipment Corporation during late-1980's that included the creation of the "knowledge lens" and "community networks". The Blueprint provided the strategic framework for Digital's Value-Added Networks Business

- ***European Internet Business Group (EIBG***) – Established and led Digital Equipment Corporation's European Internet Group for 5 years. Projects included support for the national Internet infrastructure for countries across EMEA as well as major enterprise, government & educational Intranet deployments. Dr David Probert was a sponsoring member of the European Board for Academic & Research Networking (EARN/TERENA) for 7 years (1991 ➔1998)

- ***Supersonic Car (ThrustSSC)*** – Worked with Richard Noble OBE, and the Mach One Club to set up and manage the 1st Multi-Media and e-Commerce Web-Site for the World's 1st Supersonic Car – ThrustSSC – for the World Speed Record.

- ***Secure Wireless Networking*** – Business Director & VP for Madge Networks to establish a portfolio of innovative fully secure wireless Wi-Fi IEEE802.11 networking products with technology partners from both UK and Taiwan.

- ***Networked Enterprise Security*** - Appointed as the New Products Director (CTO) to the Management Team of the Blick Group plc with overall responsibility for 55 professional engineers & a diverse portfolio of hi-tech security products.

- ***Republic of Georgia*** – Senior Security Adviser – Appointed by the European Union to investigate and then to make recommendations on *all* aspects of IT security, physical security and BCP/DR relating to the Georgian Parliament.

- ***UN/ITU*** – Senior Adviser – Development of Cybersecurity Infrastructure, Standards, Policies, & Organisations in countries within both Europe & Americas

Dr David E. Probert is a Fellow of the Royal Statistical Society. He has a 1st Class Honours Degree in Mathematics (Bristol University) & PhD from Cambridge University in Self-Organising Systems (Evolution of Stochastic Automata) , and his full professional biography is featured in the Marquis Directory of Who's Who in the World: 2007-2012 Editions.

"Smart Solutions & Architectures"

DigiTec Business Forum – Yerevan, Armenia

BACK-UP SLIDES