

## SECTION 2. INFORMATION TECHNOLOGY

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### NEW FEATURES OF ANDROID OPERATING SYSTEM

Android is an open-source platform developed under the Open Handset Alliance to enable faster development of mobile applications (further used shortening “apps”) and provision of services to the user. Google Android will be available with a lot of features that include a web browser, email client, calendar, contacts, SMS feature, maps and others. All the Google Android apps are written in Java and run on Dalvik virtual machine, which itself functions on top of a Linux kernel.

Android outstanding feature is that developers can get complete access to the identical framework APIs as used by the core app. In addition the app architecture is designed in such a way that it is possible to make the reuse of components simpler and the capabilities of any app can be published and used by any other app subject to the relevant security constraints. The users can also replace the components using the same mechanism.

The fully integrated Android package comprising an OS, middleware, apps and user friendly interface is expected to considerably speed-up product development while lowering the cost of mobile services development.

Android has many amazing and unique features that are of significance to developers and users alike, some of which are:

- App Framework that enables reuse and replacement of components
- Optimized Graphics that is powered by customized 2D graphics library and 3D graphics based on the OpenGL ES 1.0 specification
- Media Support for common video, audio, and still image formats (MPEG4, H.264, MP3, AAC, AMR, JPG, PNG, GIF)
- Provision of Bluetooth, EDGE, 3G and Wi-Fi
- SQLite for structured data storage
- Open source WebKit engine based integrated web browser
- Camera, GPS, Compass, and Accelerometer (dependent on hardware support)
- GSM Telephony
- Dalvik virtual machine optimised for mobile devices
- Rich Development environment that includes a device emulator, debugging tools, performance and memory profiling and a Eclipse IDE plugin.

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### SURVIVABILITY IN NETWORK SYSTEMS

**Survivability in Network Systems.** Contemporary large-scale networked systems that are highly distributed improve the efficiency and effectiveness of organizations by permitting new levels of organizational integration. However, such integration is accompanied by elevated risks of intrusion and compromise. These risks can be mitigated by incorporating survivability capabilities into an organization's systems. As an emerging discipline, survivability builds on

related fields of study (e.g., security, fault tolerance, safety, reliability, reuse, performance, verification, and testing) and introduces new concepts and principles. Survivability focuses on preserving essential services in unbounded environments, even when systems in such environments are penetrated and compromised.

**The New Network Paradigm: Organizational Integration.** From their modest beginnings some 20 years ago, computer networks have become a critical element of modern society. These networks not only have global reach, they also have impact on virtually every aspect of human endeavor. Networked systems are principal enabling agents in business, industry, government, and defense. Major economic sectors, including defense, energy, transportation, telecommunications, manufacturing, financial services, health care, and education, all depend on a vast array of networks operating on local, national, and global scales. This pervasive societal dependence on networks magnifies the consequences of intrusions, accidents, and failures, and amplifies the critical importance of ensuring network survivability.

A new network paradigm is emerging. Networks are being used to achieve radical new levels of organizational integration. This integration obliterates traditional organizational boundaries and integrates local operations into components of comprehensive, network-based business processes. For example, commercial organizations are integrating operations with business units, suppliers, and customers through large-scale networks that enhance communication and services. These networks combine previously fragmented operations into coherent processes open to many organizational participants. This new paradigm represents a shift from bounded networks with central control to unbounded networks.

Unbounded networks are characterized by distributed administrative control without central authority, limited visibility beyond the boundaries of local administration, and a lack of complete information about the entire network. At the same time, organizations' dependence on networks is increasing, and the risks and consequences of intrusions and compromises are amplified.

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### **INTELLIGENT DATA ANALYSIS, DATA MINING**

Total amount of information produced by humanity grows exponentially from year to year. In 2006 total data volume all over the world reached 180 exabytes (1 exabyte equals to 1 billion gigabytes). By the next year, according to the IDC Company's prediction, it will comprise 1800 exabytes that is we'll have 10 times increase in 5 years.

Of course such a great amount of information mustn't be useless. Still it is rather difficult to process it, especially if we don't know what we are looking for. For these purposes we can successfully use Data Mining methods.

Data Mining is a process of extracting patterns from raw data. It helps to reveal unknown information, some facts which we couldn't even imagine to exist. This is the main feature which marks out Data Mining from widely used statistical methods of data processing. Among most popular Data Mining methods we can name following ones:

- classifying;
- clustering;

- associational rules definition;
- neural networks;
- decision trees;
- generic algorithms.

Each of them has its own peculiarities and provides various ways for intelligent data analysis.

Classifying method divides the whole data array into specified number of classes. It consolidates data classes by some parameters, which is difficult to predict before classifying, especially in the case of multidimensional data (more than three-dimensional). With the help of classifying we can find out which factors influence data aggregation.

Clustering method also divides data into classes. Its only major difference from classifying is the fact that total number of classes is not specified a priori. As a result this method extracts natural data aggregation (clusters).

Associational rules reveals cause-and-effect relation. With its help it is possible to define and predict what happens if a defined clause takes place. For example, we can find out whether a person who bought a bread will also buy milk. Such tools are widely used in social marketing.

Neural networks make up a big class of systems which work in some way similar to the work of a human brain. Neural systems are capable to study on learning examples and make some decisions in consequence.

Decision trees make up a hierarchical structure of classifying rules like if-then. In order to make a decision to which class does an object belongs we have to answer questions which stand in nodes of a tree. All questions have the following structure "Is value of parameter A greater than X?". If YES we are moving to the right node of the next level, otherwise – to the left node.

Generic algorithms imitate mutational process over a given data sample. As a result we can obtain patterns with the best features.

Today Data Mining methods are extensively used in medicine, social marketing, economics, banking so on.

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### **WIRELESS GIGABIT TECHNOLOGY**

The widespread availability and use of digital multimedia content has created a need for faster wireless connectivity that current commercial standards cannot support. This has driven demand for a single standard that can support advanced applications such as wireless display and docking, as well as more established usages such as network access.

There was formed Wireless Gigabit (WiGig) Alliance to meet this need by establishing a unified specification for wireless communication at multi-gigabit speeds. This specification is designed to drive a global ecosystem of interoperable products.

The WiGig MAC and PHY Specification enables data rates up to 7 Gbps, more than 10 times the speed of the fastest Wi-Fi networks based on IEEE 802.11n. It operates in the unlicensed 60 GHz frequency band, which has much more spectrum available than the 2.4 GHz

and 5 GHz bands used by existing Wi-Fi products. This allows wider channels that support faster transmission speeds.

The specification enables a broad range of advanced uses, including wireless docking and connection to displays, as well as virtually instantaneous wireless backups, synchronization and file transfers between computers and handheld devices. For the first time, consumers will be able to create a complete computing and consumer electronics experience without wires.

Specification. The WiGig specification includes key features to maximize performance, minimize implementation complexity and cost, enable compatibility with existing Wi-Fi and provide advanced security. Key features include:

- Support for data transmission rates up to 7 Gbps. All devices based on the WiGig specification will be capable of gigabit data transfer rates.

- Designed from the ground up to support low-power handheld devices such as cell phones, as well as high-performance devices such as computers. It includes advanced power management.

- Based on IEEE 802.11; provides native Wi-Fi support and enables devices to transparently switch between 802.11 networks operating in any frequency band including 2.4 GHz, 5 GHz and 60 GHz.

- Support for beamforming, maximizing signal strength and enabling robust communication at distances beyond 10 meters.

- Advanced security using the Galois/Counter Mode of the AES encryption algorithm.

- Support for high-performance wireless implementations of HDMI, DisplayPort, USB and PCIe.

Conclusion. I think new technology would not be an alternative for the increasingly popular standard WiMAX, but it can find applying in high – speed corporate and home wireless networks when you want to transfer large data capacity from one device to another at relatively short distances.

The main competitor will be the Wireless HD, which also operates in the 60 GHz frequency band and is designed for wireless audio and video in HD-quality transmission between different household devices at speeds up to 28 Gbit/s, i.e. 4 times higher than in the WiGig case.

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## **SERVER VIRTUALIZATION**

Virtualization in computing - representation of the computing resources, or their logical association, that provides some advantages over the original configuration. This new virtual sight on resources is not limited by the implementation, geographic location or physical configuration of components. Usually virtualized resources include computing capacities (servers) and data storage.

Virtualization of resources organizes several physical or logical objects into resource pools (groups) with user-friendly interfaces. This includes the usage of grid systems, clusters, cloud computing, virtual storage, virtual networks etc.

Server virtualization (platform virtualization) is a technology that allows running multiple logical computers on a single physical computer. Let's consider it in more details.

Typical enterprise data center contains a lot of servers that work strongly depending on the application requirements, user activity or network conditions. So many servers spend much of their time sitting idle. This is a waste of processor's hardware resources that demands expensive power, cooling, outgoing maintenance. Server virtualization attempts to increase resource utilization by dividing physical servers into multiple virtual servers each with its own operating environment and applications. With the help of the virtualization method, each virtual server looks and acts just like a physical server, multiplying the capacity of any single machine and simplifying the server provision.

Most technically advanced form of virtualization software called hypervisor that creates a layer of abstraction between virtual servers and the native hardware. Hypervisor can run several different instances of operating systems at the same time. And virtual servers need not to be aware running virtualized environment.

Another method is running a virtual operating system in each virtual machine. Virtual operating systems are specially modified to cooperate with hypervisor. This technique is known as paravirtualization and offers considerable performance improvement.

Still other operating systems cooperate in their own form of virtualization at the kernel level. In this case virtual servers are isolated from each other but they are all running on the same operating system. The advantage of operating system virtualization is performance similar to that without any virtualization at all.

Which form of virtualization suits you best depends on various factors but the decision has been simplified by recent hardware improvements. Modern processors usually offer virtualization support that simplifies hypervisor's job improving performance independently of the virtualization form you use.

It's important to remember that server virtualization can also actually increase a complexity of IT-environment. Just like physical servers, virtual servers require service and support.

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### **CASCADING STYLE SHEETS 3**

Internet is a very dynamic IT area, so standards of using should change often. CSS has long been a powerful part of the web design process, but with the emergence of CSS3 and the growth of both the spec and the number of browsers that support it, amazing options are being opened up for designers.

So let's see what's new about CSS 3. First is that you can create scalable elements, like buttons, without having to create brand new images every time, it's very useful and makes development more flexible and fast. Using the `-webkit-transform` or `-moz-transform` calls and a designated skew, you can do some really impressive image-free effects completely in CSS. Also Dropdown Menues are now integrated to the standard. It's now possible to do much things just using CSS — even animation. Using CSS3 border radius, you can create hover effects that look really, really sharp. For example rounded borders in CSS3:

The Syntax: `border-*-*-radius: [ <length> | <%> ] [ <length> | <%> ]?`

Examples:

border-top-left-radius: 10px 5px; (Here two values are supplied these are used to define, in order, the horizontal and vertical radii of a quarter ellipse, which in turn determines the curvature of the corner of the outer border edge).

border-bottom-right-radius: 10% 5%;

border-top-right-radius: 10px;

Also there are other border features like border-break, that can close the border of a box that has been stopped at a break point (page break, column break, line break).

To create depth in our projects, just using CSS3 now we can add shadows by Box Shadows module. Because HTML5 and CSS3 are often linked together, there is some overlap in techniques. With using the we can now even create a photo gallery using only CSS3 and HTML 5. Multi-column Layout aim is to let us display our content in multiple columns with less code. The multi-column layout adds a new kind of container - column box. The content of multi-column elements flows from column to column. The column box is encapsulated within the main div container of the content. Column-count and column-width determine the number of columns and their ideal width. All columns are all of equal width and height with the same distance between them. New selectors are also very useful in development. Let see some of them:

E:only-of-type -- refers to an element which is the only sibling of its type

E:not(s) -- selects any element that doesn't match the simple selector s

E ~ F -- selects an F element that comes after an E element

E:nth-child(n) -- selects an element which is the nth child of its parent element

E:nth-last-child(n) -- same as the previous selector, but counting from the last one

E:nth-of-type(n) -- selects an element which is the nth sibling of its type

Another feature is grid positioning that allows us to create grid layouts easily.

So CSS3 gives us more opportunities to explore new ways of creating design, easily express all of your art potential in development. It makes dev easy and pleasant. Many things features where added, other – changed to better. And CSS3 is not only the update of CSS2 it's a new step in web-developing in general.

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## **BASICS OF SATELLITE COMMUNICATION SYSTEM GLONASS**

GLONASS satellites continuously emit navigation signals of two types: standard precision navigation signal (SP) in the range of L1 (1,6 GHz) and high precision navigation signal (HP) in ranges of L1 and L2 (1,2 GHz). Information provided by the navigation signal ST is available to all consumers (military and civil) and provides for the use of GLONASS receiver possibility of definitions: -Horizontal coordinates with an accuracy of 50-70 m (the probability of 99,7%);

-Vertical coordinates with an accuracy of 70 m (99,7% probability);

-Velocity vector with an accuracy of 15 cm / s (the probability of 99,7%)

-Accurate time to within 0.7 mks (99,7% probability).

GLONASS satellites structurally consist of a cylindrical germokonteyner with the dash unit, a frame of antenna-feeder devices, instruments of system orientation, solar batteries panels

with drives, propulsion unit and louver thermal control system with drives. The composition of the onboard equipment includes:

- navigation system;
- operating complex;
- a system of orientation and stabilization;
- correction system;
- thermal control system;
- power supply system.

Navigation system enables the operation of the satellite as part of the GLONASS system. Operating complex provides control of satellite systems and checks the correctness of their operation. Orientation and stabilization system provides satellite's reassurance after separation from the launcher, the initial orientation of solar panels on the sun and the longitudinal axis of the satellite to Earth, then the orientation of the longitudinal axis of the satellite at the center of the Earth and the targeting of solar panels on the sun, and also stabilization of the satellite in the orbit correction. The correction system provides a correction to bring the satellite at a specific position in the orbital plane and its retention within determined argument of latitude. Thermal control system provides the necessary thermal regime of the satellite. Power supply system includes solar panels, batteries, power automation and voltage regulation. To ensure the reliability of the satellite two or three sets of main-board systems might be established. Handling of GLONASS satellites is carried out in automated mode. Derivation of GLONASS satellites into orbit is executed by a heavy class carrier "Proton" from Baikonur. The carrier simultaneously displays three GLONASS satellites.

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### **LASER PHOSPHOR DISPLAY**

Nowadays the market of monitors is saturated by a number of different technologies like LCD, PDP, CRT, which, except for very expensive models, have significant drawbacks, such as poor color, low contrast, high energy consumption, etc.

Researchers of the Prysm have introduced a new display technology, which provide an exceptional combination of image quality, low power consumption and manufacturability. The technology is called laser phosphor display (LPD) due to two main elements: phosphor display and laser engine.

Phosphor display consists of narrow vertical lines of phosphor, each of them emits red, green or blue light when is illuminated by a laser. Phosphor layer is placed very close to the screen surface in a rigid glass or polymer structure. This display technology has the best possible viewing angle (much better then LCDs or LEDs). The other advantage is absence of the phenomenon of pixel burnout or failure that often occurs with LCD and other modern displays.

Laser Engine consists of an array of laser diodes, similar to that ones, used in Blue-ray. Diodes emit modulated laser beams to the phosphor display through the system of mirrors, which direct a laser to the appropriate point on the screen. Laser Engine and mirrors are directed by the processor, which also turns the laser off where the display is dark. One processor can work with a resolution of 1920 x 1080 pixels.

LPD provides greatly wide color gamut, high contrast and sharpness of image. There are great opportunities to create televisions with the capability to reproduce video in 3D HD, and quad HD as no principal restrictions on resolution and size is applied, and the refresh rate of displays is 240Hz.

Power consumption of this display is only 25% of LCD panel on the same brightness, which can save a lot of money, if the monitor is working around the clock. In addition LPD does not contain toxic materials and is recyclable at the end of its life, which is declared as long as 60000 hours (to 50% initial brightness). In comparison with LCD and PDP, it is a huge number.

The first generation of LPD TV is called TD1. Now it is available only for commercial use, and configurable to obtain required size and resolution. It can be useful now in airports, railway stations, institutions or architectural installation, where viewing angle is critical and perfect image is required. Large displays can be created by combining different number of tiles with the resolution of 320x240, distance in between of which is about 0.5mm.

Prysm says, that almost nothing in this generation of LPD requires new components. Production of TD1 doesn't require expensive equipment, developing of new manufacturing processes and building big factories. That means, LPD manufacturing is cheap and perspective for serial production. It can be expected on store shelves several years later.

Today LPD TV is presented on different demonstrations and if expectation of engineers would become a reality, soon LPD can be competitive with LCDs and plasma screens.

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### **USB 3.0**

Universal Serial Bus (USB) is a specification to establish communication between devices and a host controller (usually personal computers), developed and invented by Ajay Bhatt while working for Intel. USB has effectively replaced a variety of interfaces such as serial and parallel ports. USB can connect computer peripherals such as mice, keyboards, digital cameras, printers, personal media players, flash drives, Network Adapters, and external hard drives. For many of those devices, USB has become the standard connection method. USB was designed for personal computers, but it has become commonplace on other devices such as smartphones, personal digital assistant (PDA) and video game consoles, and as a power cord.

As of 2008, there are about 2 billion USB devices sold per year, and approximately 6 billion total sold to date. USB 1.0: Released in January 1996. Specified data rates of 1.5 MB/s (Low-Bandwidth) and 12 Mbit/s (Full-Bandwidth). Does not allow for extension cables or pass-through monitors (due to timing and power limitations). Few such devices actually made it to market. USB 1.1: Released in September 1998. Fixed problems identified in 1.0, mostly relating to hubs. Earliest revision to be widely adopted. USB 2.0: Released in April 2000. Added higher maximum bandwidth of 480 Mbit/s [60 MB/s] (now called "Hi-Speed"). Further modifications to the USB specification have been done via Engineering Change Notices (ECN). The most important of these ECNs are included into the USB 2.0 specification package available from.

The USB 3.0 Promoter Group announced on 17 November 2008, that version 3.0 of the specification had been completed and had made the transition to the USB Implementers Forum (USB-IF), the managing body of USB specifications. This move effectively opened the



specification to hardware developers for implementation in future products. The first certified USB 3.0 consumer products were announced 5 January 2010, at the Las Vegas Consumer Electronics Show (CES), including two motherboards by ASUS and Gigabyte Technology. Manufacturers of USB 3.0 host controllers includes, but are not limited to, Renesas/NEC Electronics, Fresco Logic, Asmedia, Etron, VIA Labs and Texas Instruments. As of November 2010, Renesas is the only company to have passed USB-IF certification, although motherboards for Intel's Sandy Bridge processors have been seen with Asmedia and Etron host controllers. AMD is working with Renesas to add its USB 3.0 implementation into its chipsets for its 2011 platforms. SuperSpeed USB brings significant performance enhancements to the ubiquitous USB standard, while remaining compatible with the billions of USB enabled devices currently deployed in the market. SuperSpeed USB will deliver 10x the data transfer rate of Hi-Speed USB, as well as improved power efficiency. Advantages of SuperSpeed USB :

1. SuperSpeed USB has a 5 Gbps signaling rate offering 10x performance increase over Hi-Speed USB.
2. SuperSpeed USB is a Sync-N-Go technology that minimizes user wait-time.
3. SuperSpeed USB will provide Optimized Power Efficiency. No device polling and lower active and idle power requirements.
4. SuperSpeed USB is backwards compatible with USB 2.0. Devices interoperate with USB 2.0 platforms. Hosts support USB 2.0 legacy devices.

SuperSpeed establishes a communications pipe between the host and each device, in a host-directed protocol. In contrast, USB 2.0 broadcasts packet traffic to all devices. USB 3.0 extends the bulk transfer type in SuperSpeed with Streams. This extension allows a host and device to create and transfer multiple streams of data through a single bulk pipe.

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## **RISK MANAGEMENT FOR INFORMATION TECHNOLOGY SYSTEMS**

An effective risk management process is an important component of a successful IT security program. The principal goal of an organization's risk management process should be to protect the organization and its ability to perform their mission, not just its IT assets. Therefore, the risk management process should not be treated primarily as a technical function carried out by the IT experts who operate and manage the IT system, but as an essential management function of the organization.

Risk is the negative impact of the exercise of a vulnerability, considering both the probability and the impact of occurrence. Risk management is the process of identifying risk, assessing risk, and taking steps to reduce risk to an acceptable. The objective of performing risk management is to enable the organization to accomplish its mission by better securing the IT systems that store, process, or transmit organizational information.

Risk management encompasses three processes: risk assessment, risk mitigation, and evaluation and assessment.

There are a number of distinct approaches to risk analysis. However, these essentially break down into two types: quantitative and qualitative.

Quantitative Risk Analysis - this approach employs two fundamental elements; the probability of an event occurring and the likely loss should it occur. Quantitative risk analysis makes use of a single figure produced from these elements. This is called the 'Annual Loss Expectancy (ALE)' or the 'Estimated Annual Cost (EAC)'. This is calculated for an event by

simply multiplying the potential loss by the probability. It is thus theoretically possible to rank events in order of risk (ALE) and to make decisions based upon this.

Qualitative Risk Analysis-this is by far the most widely used approach to risk analysis. Probability data is not required and only estimated potential loss is used. Most qualitative risk analysis methodologies make use of a number of interrelated elements: threats, vulnerabilities, controls.

Threats-these are things that can go wrong or that can 'attack' the system. Examples might include fire or fraud. Threats are ever present for every system.

Vulnerabilities - these make a system more prone to attack by a threat or make an attack more likely to have some success or impact.

Controls-these are the countermeasures for vulnerabilities. There are four types:

- Deterrent controls reduce the likelihood of a deliberate attack
- Preventative controls protect vulnerabilities and make an attack unsuccessful or reduce its impact
- Corrective controls reduce the effect of an attack
- Detective controls discover attacks and trigger preventative or corrective controls.

There are numerous risk assessment/management methodologies and tools. The following methodologies and tools were developed for managing risks in information systems: National Institute of Standards & Technology (NIST) Methodology, OCTAVE, FRAP, COBRA, Risk Watch, Grid.

A well-structured risk management methodology, when used effectively, can help management identify appropriate controls for providing the mission-essential security capabilities.

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### **RESEARCH METHODS FOR INCREASING PROGRAMS SPEED**

Writing code that runs quickly is sometimes at odds with writing code quickly. C.A.R. Hoare, computer science luminary and discoverer of the QuickSort algorithm, famously proclaimed, "Premature optimization is the root of all evil." The extreme programming design principle of "You Aren't Gonna Need It" (YAGNI) argues against implementing any features, including performance optimizations, until they're needed. Performance tuning for real-world applications often involves activities geared towards finding bottlenecks: in code, in the network transport layer, and at transaction boundaries.

Performance is one of the key characteristics of a program. To achieve maximum results in this area you can use several methods:

- Optimization at the language level.
- Parallelization of computational processes.
- Optimization of computational algorithms.
- Using special mathematical or algorithmic libraries.

"Fastest" will be low-level language and so-called "native" to the environment of the application languages. However, it is important to take into account created program size and the development time.

There are two approaches for parallelism in microprocessor-based systems called single-threaded and multithreaded parallelism. Single-thread parallelism is the parallel

execution of operations within a single thread. Multithreaded parallelism is using of multiple threads for parallel execution of operations. In order to provide a multi-threaded parallelism you must create a system with multiple processors or processor cores.

A special case of parallel computing is distributed computing - the simultaneous solution of various parts of a computational problem by multiple processors (or cores of one processor) of one or more computers.

Changing the algorithm provides more rapid and efficient methods of calculation (if any exist). Each year scientists develop, update and improve algorithms that have been solved long ago. The main task of the developer is to choose the most optimal for this case. Question of choosing the method of calculation is very important for programs working with matrices of large dimension, performing complex mathematical calculations or implement the approximate calculations.

For specialized tasks it is desirable to use a specially designed library. They will help to reduce the time of writing the required modules and provide a fast and optimal solution of the necessary tasks. However, some libraries are complex or it is difficult to use them to solve basic problems.

At the final stage, we should use the so-called profilers ("profilers") - the main tool for programs optimizer. The main purpose of profiling is to study the behavior of applications at all points. Finding of such "critical" points, finding the cause and fix them would increase the optimality of the program and increase its performance.

Optimization results will be improved program that will run faster and more stable. The graph CPU utilization will be smoother.

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## **DEVELOPMENT AND PROSPECTS OF UMTS IN THE WORLD**

UMTS (Universal Mobile Telecommunication System) is the first global wireless standard, J-Phone in Japan, which uses W-CDMA access technology can interface with UMTS, in contrast, the current GSM networks are available everywhere except Japan and Korea.

In the United Kingdom, 2003, the first UMTS network was enabled, with the title "3". Mainly owned by Hutchison Whamopa and various partners, whom change from country to country.

These countries include, Sweden, Ireland, Israel, Italy, Australia, Austria, Hong Kong and Denmark. Most countries whose network operators are still using 2G, plan to upgrade to 3G as it's an easy evolution between GSM and UMTS networks.

There have been various launches in various countries, December 2003, the service provider T-Mobile launches a UMTS network in Austria, and trials in the Germany and the UK. Shortly after this, in February 04, Vodafone launched a huge UMTS upgrade on its European networks, such as Sweden, Germany, Netherlands and the UK.

In the US, AT&T will offer UMTS 1900, meaning that it will operate on the 1900MHz spectrum only; this is due to the fact that the spectrum has already been allocated in the US. UMTS phones that are sold for US use will probably not work on other countries UMTS networks. This is similar to the situation with current GSM networks in the US, which uses different frequencies from the rest of the world. This could change, as the FCC started to free

up spectrum in the 2100 MHz band, its obvious global roaming is considered an important issue.

There has also been a combination of 3G and Wi-Fi products developed, where Laptop or PDA users use a UMTS modem, a Wi-Fi Adaptor, and a piece of software. This software sense the available networks and switches between them, if a Wi-Fi connection is available, the software will connect to that, should Wi-Fi not be available, the UMTS is selected. Original feeling was that Wi-Fi was a competitor with UMTS, but it is now seen as a cooperation between standards which help the struggle against fast, wireless global roaming.

Currently, there is no ability to roam between US and European & Asian UMTS networks; however, roaming between European and Asian UMTS networks is perfectly possible. 3.5G is also on the horizon, and will be the GPRS of 3G, providing faster rates to a mobile device, while 4G is due around 2010. 3.5G will use HSPDA, or High Speed Downlink Packet Access, which increases the downstream transfer capability to 10Mbit/s.

The main driving force in the marketing arena of UMTS is the possibility for video conferencing, while video calling become less popular than expected, it remains to be seen whether there's a market for video conferencing in the future. Of course, there are many other uses for UMTS, such as music downloads, video downloads, rich content websites, etc, and as mobile devices capability and power increase, so it will lead to new features and uses. High speed mobile data links will encourage device manufacturers to create handsets with rich features as soon as possible; proof of this can be seen already with the latest 1.3MP on phone cameras.

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## **THE KEE4 KEYBOARD – COMPUTING'S FUTURE AT YOUR FINGERTIPS**

People have been using computer for a long time, so they are already used to our multibutton keyboards. Now people think that without putting on these little diversiform buttons they won't get much done. It's an effortless interaction between a human and a machine. As technology advances, now we can find other ways to interact with our computers.

Do you know you need only 4 keys on your keyboard? If you listen to the guy who developed the Kee4, you'll see the reason why. Citta Consulting Inc. has developed a keyboard consisting of only four keys. But don't worry, you will be able to type any character that you can type with your normal keyboard. Kee4 Keyboard – a one-handed, four-button device that can do pretty much anything we do now with our giant plastic equipment. It operates wirelessly with computers, smartphones, MIDs, and tablets via Bluetooth to any of these device with HID support, without the need for any extra software or drivers.

The Kee4 keyboard has two parts: a base with the four keys and a small pouch for the thumb. When you typing with this device, the thumb is inserted in the pouch to keep it safe, secure, out of trouble and holds the keyboard in place, so that the four fingers rest comfortably on the four keys. Each finger has its own key and never has to move away from it or from key to key. Using this small device, you release for yourself much place on your desk, for instance, for side of the body, armrest, desktop or any other object. Your hands would normally rest on.

While it can be used free-handed, it is recommended that the Kee4 be placed against a flat surface or stable body part in order to maximize the effectiveness of the keystrokes.

But how does it work - with only 4 keys?! It's a different way of working it though, that's for sure. For typing you must use "composite keystrokes". This is a combination of two keys pressed and released in a specific order. There are two categories of this: rocking keystrokes and rolling keystrokes. If the key that was pressed second is the first to be released, that is called a 'rocking keystroke' - it suggests a rocking motion from one finger to the other and contrariwise. If the key that was pressed first is the first to be released - it is a 'rolling keystroke'. It suggests a rolling movement of the hand from one finger to another. Using the Kee4 can also type special language characters, uppercase letters, and function controls (ALT and CTRL commands).

It is unusual typing but with a bit of training, it will be easy as 1, 2, 3 they say. It's also got a great potential future in mobile computing for some people whose fingers are too fat for any of the tiny phones. Kee4 offers an opportunity to join the rest of the computing world in their love of keyboard-assisted typing.

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## **PRINTING METHODS OF PROTECTION FROM FALSIFICATION THE PRINTED PRODUCTS**

Ways to protect the product from the hands of counterfeiters to date, fortunately, quite a lot, and their number is growing every year, as indeed, the very methods of fraud. Therefore, to avoid for sure, this material is devoted exclusively to those which are implemented using printing technology. Protective images can be divided into several groups: fine graphics and microdesign; background design; latent image; lathe-work elements; cinegram; bar code; variable information; watermarks; corresponding designs.

There are many protection technology of the printed products, such as: printed by intaglio; orel printing; iridescent printing; offset and letterpress; gravure printing; blind and foil stamping; microprinting; micrographics; tangirnye or masking grid; lathe-work elements; Void Pantograoh; Copy Ban; security numbers; various bar codes, OCR, MICR-codes; hewing under the original form; selective varnishing; punching, which reduces resistance; holograms; chemical and mechanical Void; Laser Look; Laser Choice and so on. This is short description some from them.

One of the most common methods of protection of printed products it is giloshirnye elements and tangirnye grid. Giloshirnye and tangirnye elements - this is a system of intersecting curves, thin lines that form the background images, which, due to the small thickness of the lines can not be properly scanned, and therefore reproduced by copy machines.

Mikrografika is a composition of thin graphical elements, small details which are not visually distinguishable. Microprinting can be presented both as microtext (text, human readable form in solid lines, but read with a magnifying instrument), and as mikrouzora (figure from thin, tightly spaced lines and geometric elements). Microprinting protects from copying because it is impossible to achieve with the required permission: when copying using different methods of scanning or rasterizing images microprinting not play, but when using photomechanical processes, it is transmitted with considerable distortion. By mikrografike can

be attributed, and images created using images from a complex form of points, such as polygons, stars, etc.

Giloshirnye elements and tangirnye mesh advisable to use only in combination with other methods of protection. To identify the authenticity of the document is protected by a thin graphics, visual inspection is not enough - must use magnifying devices.

Hidden images are graphic elements, especially hidden in the design of printed materials, such as in composite thin graphics. Hidden images are visible either by looking at the print at a certain angle, or at the control with the use of special tools. When rigging label hidden images or destroyed and become invisible to copy, or vice versa - revealed, indicating forgery. An example of the second variety of these images is drawings or inscriptions that appear in the falsification of documents using copiers.

One way to identify products and simplify the detection of counterfeits can print variable information, ie personalization of documents, which is a kind of numbering. To print the variable information used numbering heads and digital printers. There are plenty of bar codes, which are used in different areas of life, depending on specification.

Today these methods of protection were the largest circulated protecting special reports, public documents.

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### **CODE DIVISION MULTIPLE ACCESS**

This work introduces spread-spectrum modulation and CDMA concepts. It presents several design considerations tied to those concepts, including the structure of the spreading signal, the method for timing synchronization, and the requirements for power control.

CDMA is a multiple-access scheme based on spread-spectrum communication techniques. It spreads the message signal to a relatively wide bandwidth by using a unique code that reduces interference, enhances system processing, and differentiates users. CDMA does not require frequency or time division for multiple access; thus, it improves the capacity of the communication system.

Time division multiple access (TDMA) is a channel access method for shared medium (usually radio) networks. It allows several users to share the same frequency channel by dividing the signal into different timeslots. The users transmit in rapid succession, one after the other, each using his own timeslot. This allows multiple stations to share the same transmission medium (e.g. radio frequency channel) while using only the part of its bandwidth they require.

Frequency Division Multiple Access or FDMA is an access technology that is used by radio systems to share the radio spectrum. The terminology "multiple access" implies the sharing of the resource amongst users, and the "frequency division" describes how the sharing is done: by allocating users with different carrier frequencies of the radio spectrum.

Spread-spectrum telecommunications is a signal structuring technique that employs direct sequence, frequency hopping or a hybrid of these, which can be used for multiple access and/or multiple functions. This technique decreases the potential interference to other receivers while achieving privacy. Spread spectrum generally makes use of a sequential noise-like signal structure to spread the normally narrowband information signal over a relatively wideband (radio) band of frequencies.

In Code Division Multiple Access (CDMA) systems all users transmit in the same bandwidth simultaneously. Communication systems following this concept are "spread spectrum systems". In this transmission technique, the frequency spectrum of a data-signal is spread using a code uncorrelated with that signal. As a result the bandwidth occupancy is much higher than required.

The codes used for spreading have low cross-correlation values and are unique to every user. This is the reason that a receiver which has knowledge about the code of the intended transmitter, is capable of selecting the desired signal. The advantage of CDMA for personal communication services is its ability to accommodate many users on the same frequency at the same time. As we mentioned earlier, a specific code is assigned to each user and only that code can demodulate the transmitted signal.

CDMA codes are not required to provide call security, but create a uniqueness to enable call identification. Codes should not correlate to other codes or time shifted version of itself. Spreading codes are noise like pseudo-random codes, channel codes are designed for maximum separation from each other and cell identification codes are balanced not to correlate to other codes of itself.

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## **APPROXIMATION ALGORITHMS**

In computer science and operations research, approximation algorithms are algorithms used to find approximate solutions to optimization problems. Approximation algorithms are often associated with NP-hard problems; since it is unlikely that there can ever be efficient polynomial time exact algorithms solving NP-hard problems, one settles for polynomial time sub-optimal solutions. Unlike heuristics, which usually only find reasonably good solutions reasonably fast, one wants provable solution quality and provable run time bounds. Ideally, the approximation is optimal up to a small constant factor (for instance within 5% of the optimal solution). Approximation algorithms are increasingly being used for problems where exact polynomial-time algorithms are known but are too expensive due to the input size.

A typical example for an approximation algorithm is the one for vertex cover in graphs: find an uncovered edge and add both endpoints to the vertex cover, until none remain. It is clear that the resulting cover is at most twice as large as the optimal one. This is a constant factor approximation algorithm with a factor of 2.

NP-hard problems vary greatly in their approximability; some, such as the bin packing problem, can be approximated within any factor greater than 1 (such a family of approximation algorithms is often called a polynomial time approximation scheme or PTAS). Others are impossible to approximate within any constant, or even polynomial factor unless  $P = NP$ , such as the maximum clique problem.

NP-hard problems can often be expressed as integer programs (IP) and solved exactly in exponential time. Many approximation algorithms emerge from the linear programming relaxation of the integer program.

Not all approximation algorithms are suitable for all practical applications. They often use IP/LP/Semidefinite solvers, complex data structures or sophisticated algorithmic techniques which lead to difficult implementation problems. Also, some approximation algorithms have

impractical running times even though they are polynomial time, for example  $O(n^{2000})$ . Yet the study of even very expensive algorithms is not a completely theoretical pursuit as they can yield valuable insights. A classic example is the initial PTAS for Euclidean TSP due to Sanjeev Arora which had prohibitive running time, yet within a year, Arora refined the ideas into a linear time algorithm. Such algorithms are also worthwhile in some applications where the running times and cost can be justified e.g. computational biology, financial engineering, transportation planning, and inventory management. In such scenarios, they must compete with the corresponding direct IP formulations.

Another limitation of the approach is that it applies only to optimization problems and not to "pure" decision problems like satisfiability, although it is often possible to conceive optimization versions of such problems, such as the maximum satisfiability problem (Max SAT).

Inapproximability has been a fruitful area of research in computational complexity theory since the 1990 result of Feige, Goldwasser, Lovasz, Safra and Szegedy on the inapproximability of Independent Set.

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## **STAGES OF CREATION OF TELEMEDICAL CENTER**

Telemedicine is rapidly integrated into the health care system. More and more clinics provide videoconference services, remote monitoring of the health of the patient. However, in each country, and even in a particular region, there are unique features of health systems, socio-economic and geographical conditions. That's why, one of the important problems of modern medicine is creation of telemedical center which will be economically advantageous and will be most useful to the patients. To solve this problem is necessary to combine the latest knowledges in the field of medicine, management, IT technologies.

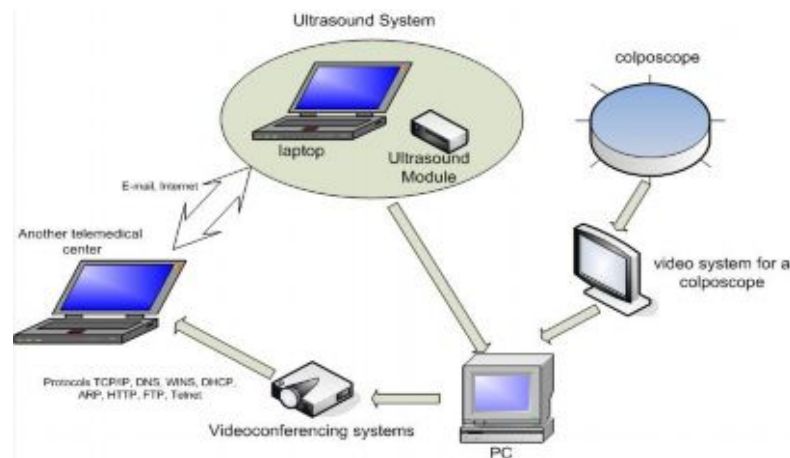
For successful telemedicine center planning first of all is necessary to define the objectives. The main objectives of telemedicine is teleconsultation, remote patient monitoring or medical education.

For the next step it is necessary to choose the area of medicine (telecardiology, teleradiology, telepsychiatry, telepathology) in which our telemedical center will work. Depending on it apply the different types of consultations: store-and-forward and interactive services. Store-and-forward telemedicine involves acquiring medical data and then transmitting this data to a doctor at a convenient time for assessment offline. Interactive telemedicine services provide real-time interactions between patient and provider, to include phone conversations, online communication and home visits.

The third step is to choose the most suitable equipment and organization of telemedicine system. A Telemedicine system normally consists of a Personal Computer (PC) with Telemedicine software, a videoconferencing system and diagnostic instruments.

For example, if your center will be engaged in problems of gynecology telemedicine system might look as shown in figure 1.





**Figure 1. Example of telemedicine system**

One of the most important is the recruitment of staff. In contrast to the usual medical center staff should include a system administrator and engineer.

All of it requires expenses, but purchase and maintenance charges of the telemedical systems is quickly compensated by reducing the cost of patients treating.

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#### **FOURTH GENERATION OF THE INTERNET**

A fourth generation network is the fourth generation of wireless communication. While still in development, the foundations for the replacement of the present network is currently being researched and constructed by the cellular phone industry and other technology developers. A fourth generation system is expected to provide a comprehensive and secure all Internet Protocol based solution where facilities such as Internet Protocol telephony, ultra-broadband Internet access, gaming services, and streamed multimedia may be provided to users.

This new technology works four times as fast as the current third generation technology available with most mobile smart phones. With a third generation network, wireless mobile phones were able to download at 2 Megabits per second.

At that time International Mobile Telecommunications Advanced cellular system must have target peak data rates of up to approximately 100 Megabits per second for high mobility such as mobile access and up to approximately 1 Gigabit per second for low mobility such as local wireless access, according to the International Telecommunication Union requirements. Scalable bandwidths up to at least 40 megahertz should be provided.

In fourth generation there are two main types of technology that are being considered by mobile network providers at present, and these are Long Term Evolution fourth generation technology and Worldwide Interoperability for Microwave Access fourth generation technology. These two types of fourth generation technology offer similar features and benefits although the technology itself is very different. At present providers have not decided which of these two types they will be deploying, but they are currently conducting trials of both.

The fourth generation system was originally envisioned by the Defense Advanced Research Projects Agency. This agency selected the distributed architecture, end-to-end Internet protocol, and believed at an early stage in peer-to-peer networking in which every mobile device would be both a transceiver and a router for other devices in the network eliminating the spoke-and-hub weakness of second generation and third generation cellular systems. However, the first Long Term Evolution Universal Serial Bus dongles do not support any other radio interface. Although legacy systems are in place to adopt existing users, the infrastructure for fourth generation will be only packet-based. Some proposals suggest having an open Internet platform.

Unlike third generation, which is based on two parallel infrastructures consisting of circuit switched and packet switched network nodes respectively, fourth generation will be based on packet switching only. This will require low-latency data transmission.

With fourth generation technology the network capacity is greatly improved compared to third generation technology, and this means that the networks will be able to easily cope with the rising demand for mobile internet services, whereas the current third generation networks are under increasing strain. This will mean that with fourth generation both casual and business users that want to get online whilst out and about will be able to enjoy faster speeds, better coverage, greater reliability, and a more efficient and effective service despite the increase in the number of people using the technology.

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## **PROBLEMS OF DATA TRANSMISSION IN MOBILE NETWORKS**

Avalanche growth of Internet resources, the trend towards greater mobility of subscribers, combining several transmission technologies of various types of traffic, as well as the emergence of mobile user applications cause a considerable interest in the issue of ensuring the effective transmission of different kinds of traffic over wireless communications networks. Opportunities of mobile users to access the Internet is now associated mostly with the two technologies - cellular networks and wireless local-area networks (LANs).

Many Internet-based applications use the Transmission Control Protocol (TCP) as the transport protocol. It ensures error-free delivery of data from one host to another, and also carries out a clear segmentation and reassembly of user data, ensures flow control and congestion avoidance. Stack TCP / IP protocols at the time have been once designed for wired communication networks and its application in wireless communication networks often leads to significant deterioration of communication performance. The main features of traffic transmission in cellular networks and wireless LANs are considered regarding the specific characteristics of the TCP / IP stack in relation to a data link and the transport layers of the Reference Model Open Systems Interconnection (OSI).

High level of data link errors which has a considerable effect on the parameters of data transmission in mobile networks and wireless LANs is inherent for mobile communication networks unlike wireline networks. The main reason for their occurrence in the wireless LAN is a fading signal, due to its multipath. Constantly moving subscribers influence error stream parameters which are constantly changing and are difficult to predict.

Nowadays a large number of methods have been developed and researched to improve transmission characteristics of user traffic in mobile networks developed and investigated. All these methods can be divided into two major groups of solutions that are implemented at transport or data link layers.

The report introduces the results of work that are directed to improve the effect of data transmission in mobile networks and wireless LANs.

- ◆ Methods of separating TCP-connections to several parts using timestamps have been used to improve the efficiency of data transmission on the transport layer.

- ◆ Methods of the opaque regime of the RLP-protocol, the local correction of errors in the IP-layer have been applied to improve the efficiency of data transmission on the data link layer.

- ◆ A convenient system for the visualization of calculated data using web-interface or integration with existing mapping applications was developed.

Modern implementation of tiered architecture of wireless hosts do not always provide effective data transmission in mobile communications. The report analyzed the causes of reduced efficiency of the TCP protocol for data transmission over cellular and local radio networks, as well as the basic solution of the transport and data link layers, allowing to deal with emerging problems.

These methods can help to increase the efficiency of data transmission in mobile networks, and they are a theoretical basis for the development of new, more effective methods.

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## **INTELLECTUAL CAPITAL INCREASE BY USE OF INTERNET**

Methods of intellectual capital growth at the expense of unused or incompletely use reserves are important for the most companies and banks. Therefore, a problem of intellectual capital increase through Internet use becomes more urgent.

In this report a possibility of intellectual capital increase for companies via Internet at the expense of new application of existing methods is presented.

The main ways to increase intellectual capital through Internet are to create Internet communities, blogs, network partnerships and implementation of network cooperation.

The Internet community is a group of people who use Internet as a basic tool for organizing space group interaction participants. Examples of Internet communities are wikis, forums, chats, etc. [1].

Blog is a web site where the basic content is regularly added with records that contain text, images or multimedia. Blogs allow you to freely receive information to people living in different parts of the world.

A new opportunity to increase intellectual capital within the company would be to create Internet communities and blogs within organization. After that, people could acquire new answers to their questions in an environment closest to their problems.

Today partnerships are often formed network to obtain a new intellectual product, based on trust and encourage further technological development. A reason for intensification of the learning processes lies in the fact that the parties of venture alliance refuse from protective measures to control the spread of new knowledge for the benefit of confidence and more free communication between the parties.

Network cooperation is useful for accumulation of intellectual capital within large organizations. A striking example of cooperation network has become interdisciplinary venture alliances that seem to be more profitable than the direct absorption of junior partners. To improve results of large corporations the dissemination of knowledge between its offices around the world is extremely effective by Internet. The development of this direction is promising.

Thus, to date, an increase of intellectual capital of companies by wider use of Internet is very effective. For more effective work of people it is useful to accomplish such structures as Internet community, blogs, network partnerships and to implement network cooperation. The development of these areas within large organizations will contribute to accumulation of their intellectual capital.

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### **SCHEDULING PROBLEM IN GRID SYSTEMS**

Grid is a distributed computer system which includes different kinds of resources such as processors, memory, databases, etc [1]. It doesn't matter where you would like to access grid's resources because it's available anywhere where you can access the Internet. Grid systems tend to be loosely coupled, heterogeneous and geographically dispersed which makes some restrictions on its structure. It should have a middleware to afford a single interface to each element included to the system.

There are several types of grid systems such as voluntary grid, scientific grid and enterprise grid. Each of them is designed for special type of problems which requires a lot of computer resources. Enterprise grid is designed for business purpose, scientific grid is designed for researching and voluntary grid is used for any other purpose.

Working with grid systems you should remember that there are some restrictions on the tasks which are solved using grid systems. If there are many transfers made between nodes in your task it would take much longer to get a result.

As grid technology is quite modern technology. There are some strong and weak points of its design. The weaknesses are supporting a single interface, data transfer and scheduling and the strong point is integration of many computing system into a single computing system. Scheduling is one of the most important and complicated parts of each grid system [2]. There are several common ways of it such as BackfillLocal, BestFitLocal, FirstFitLocal and RandomFitGlobal. Each way has its own advantages and disadvantages.

BackfillLocal is an implementation of the Backfill algorithm which means that a lower priority task might be run out of turn only if it doesn't prevent running of more priority task. It is the most balanced method of scheduling but the implementation is quite complicated and it works rather slow [3].

BestFitLocal is an implementation of the algorithm where next task is selected only if it suits the most for this system. Method is good for a certain category of problems and is not suitable for others.

FirstFitLocal is an implementation of the algorithm where next task is selected from the beginning of the queue. The implementation of this method is simple and it has predictable expectations.

RandomFitGlobal is an implementation of the random method. It has the most simple implementation and it is the most unpredictable, because you never know how long you'll need to wait.

Grid systems provide the ability to create a powerful and scalable computing resource, but the extension of grid system makes it necessary to optimize the scheduling problem, which can be solved in many different ways depending on the particular problem.

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## **GENERATION OF ELECTRONIC PAPER**

The scarcity of natural resources for production of paper and ink inspired people to create alternative methods of information dissemination, which would allow to save material and avoid the accumulation of "waste paper". Solving these problems came with the invention of electronic paper. Electronic paper is present in the market for about five years but still considered a newcomer.

Electronic paper is a proprietary material that is processed into a film for integration into electronic displays. Although revolutionary in concept, electronic paper is a straightforward fusion of chemistry, physics and electronics to create this new material. The principal components of electronic paper are millions of tiny microcapsules, about the diameter of a human hair. In one incarnation, each microcapsule contains positively charged white particles and negatively charged black particles suspended in a clear fluid. When a negative electric field is applied, the white particles move to the top of the microcapsule where they become visible to the user. This makes the surface appear white at that spot. At the same time, an opposite electric field pulls the black particles to the bottom of the microcapsules where they are hidden. By reversing this process, the black particles appear at the top of the capsule, which now makes the surface appear dark at that spot.

Electronic paper is used as electronic price tags in stores, the schedules of public transportation stops, displays in mobile phones and devices which display digital versions of books and magazines.

E-paper is more comfortable to read than conventional displays because of holding text and images indefinitely without drawing electricity, while allowing the image to be changed later. This is due to the stable image, which does not need to be refreshed constantly, the wider viewing angle, and the fact that it reflect ambient light rather than emitting its own light. An e-paper displays can be read in direct sunlight without the image appearing to fade. A

device for reading electronic books and newspapers on display at the e-ink technology is thickened by a sheet of paper, it can be folded and rolled into a roll. Innovation is much stronger than paper, not afraid of water, bright sun, snow. Electronic books and newspapers with mass production expected to be affordable to everyone could meet their needs for obtaining information, news, distance learning, reading literature.

Electronic paper technologies have a very low refresh rate comparing with other low-power display technologies, such as LCD. This prevents producers from implementing sophisticated interactive applications (using fast moving menus, mouse pointers or scrolling) like those which are possible on handheld computers. Another limitation is that an imprint of an image may be visible after refreshing parts of the screen. This effect is reminiscent of screen burn-in but, unlike it, is solved after the screen is refreshed several times. Turning every pixel white, then black, then white, helps normalize the contrast of the pixels.

In spite of some disadvantages, this technology has become widespread. Applications include electronic pricing labels in retail shops, and general signage, time tables at bus stations, electronic billboards, mobile phone displays, and e-Readers capable of displaying digital versions of books and e-paper magazines. This technology is actively developed and improved, because it is a very promising.

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## **NEW BASIC SCHEMATIC ELEMENT PROMISES THE TRUE AI TO EMERGE**

When the transistor was invented in the 1960s, scientists predicted that by the term of 20 years a machine smarter than its creator would be built. However, after more than half of century past, today's most intelligent computers can't match even a three-year-old child's brain with its abilities of interacting and exploring outer world – and using this skills to achieve its aims. The extreme hardware and software complexity of these machines compared with the poor results scientists have reached using them to simulate the brain activity has eventually led lots of them to state that it's impossible to create real artificial intelligence based on traditional Boolean logic and either Harvard or von Neumann architecture. The reason for that is simple – this is just not the way the brain is organized. To understand the difference between human-made and biological computers the simplified models are introduced below.

Modern microprocessors and microcontrollers mostly consist of the same common blocks such as arithmetic-logic unit, control unit, memory. The only difference in the particular architectures and their realization lies in the organization of the way these basic blocks interact with each other. The memory and processor are separated by the data bus of limited capacity which automatically limits the computer's maximum performance.

Now, let's have a look on the brain architecture. The brain consists of billions nerve cells called neurons. Each neuron has some number of "inputs" - dendrites and "outputs" - axons which transmit electrical impulses from one neuron to another. These neuron interconnections are called synapses and in fact are the place where the nervous' system data processing happens. To understand the way how brain acts here's an example of data impulse passing two neurons: the neuron A emits an impulse via its axon right to the synapse of the neuron B. The synapse of the neuron B analyzes the priority of the neuron A compared to the other neurons the neuron B is connected to. After that, the information from neuron A and

information about its importance from neuron B synapse is transformed into another information pulse, which neuron B sends to the next cell. The most important thing in this example is that the data processing and transferring in brain is made simultaneously. This fact, especially taking into account that each neuron is connected to tens of other ones, gives an answer why the brain's processing power is this great.

So why still we don't have intelligent machines with processors based on brain-type architecture even though understanding the theoretical principles of the way they should principle? The reason lays in the absence of simple passive schematic elements capable of performing both memory and signal transfer functions. Such an element was theoretically predicted and named memristor by Leon Chua in a 1971. The memristor is a passive two-terminal electronic component for which the resistance ( $dV/dI$ ) depends in some way on the amount of charge that has flowed through the circuit. When current flows in one direction through the device, the resistance increases; and when current flows in the opposite direction, the resistance decreases, although it must remain positive. When the current is stopped, the component retains the last resistance that it had, and when the flow of charge starts again, the resistance of the circuit will be what it was when it was last active.

The practical realization of memristor appropriate for wide implementation in microprocessor technique seemed impossible until April 15, 2008, when a nanoscale 2-terminal resistance switch crossbar array formed as a neural network was patented.

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## **STRUCTURING INFORMATION METHODS DEVELOPMENT FOR IMAGE SEARCH**

With the IT development, a large amount of information is increasing rapidly. That's why structuring information methods development for subsequent search is vitally important. Nowadays there are enough efficient systems in the images searching area, but most of them are too highly specialized.

The segmentation is one of the main parameters of an image. The number of segments, their size, relative location and color define the basic structure of the image. Therefore, the segmentation analysis is one of the most important tasks when we search for similar images.

In the developed system we use an efficient segmentation algorithm based on graphs. Graph-based image segmentation techniques generally represent the problem in terms of a graph  $G = (V; E)$  where each node  $V$  corresponds to a pixel in the image, and the edges in  $E$  connect certain pairs of neighboring pixels. A weight is associated with each edge based on some properties of the pixels that it connects, such as their image intensities. Depending on the method, there can be an edge connecting each pair of vertices. The earliest graph-based methods use fixed thresholds and local measures in the image segmentation. The work of Zahn presents a segmentation method based on the minimum spanning tree (MST) of the graph. This method has been applied both to point clustering and to the image segmentation. For the image segmentation the edge weight in the graph is based on the differences between pixel intensities, whereas for point clustering the weights are based on distances between points.

The main point of the algorithm is that each pixel is represented with a vertex of the graph. Initially, bi-directional edges are built between all neighboring vertices and for each edge its weight is calculated as the Euclidean distance between points in space (coordinates)

and RGB color components. After that, all the edges are sorted according to the found weights. Then the minimum spanning tree is formed using the Krasskala algorithm. Finally disjoint sets of vertices are obtained, which are the needed image segments.

To speed up the algorithm, the input image's size is reduced and image passes through a sharp-filter that enhances contrast transitions between objects, making it easier to partition an image.

After partitioning the image into segments, you need to analyze the results. To achieve this, all the segments are sorted by their power, the area of the largest segments is calculated and their center and color content are determined.

Such analysis is made for all the images and information as segments are added to the digital wavelet-sketches in the database.

The incoming picture also passes through the segmentation analysis module. After that, incoming picture segmentation characteristics are compared in pairs with the appropriate values of images in the database.

The result of comparison is a numerical costing of the image segmental structure similarity. This evaluation is a component of incoming picture and images overall similarity assessment in the database.

We apply this approach to find similar images and as a result it helps to improve search results, because segmental structure is an important factor when we compare images

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## **SPEECH RECOGNITION OVERVIEW**

Speech recognition, often called automatic speech recognition, is the process by which a computer recognizes what a person said. If you are familiar with speech recognition, it 's probably from applications based around the telephone. If you've ever called a company and a computer asked you to say the name of the person you want to talk to, the computer recognized the name you said through speech recognition. This is very different from a computer actually understanding what you said. When two people speak to one another, they both recognize the words and the meaning behind them. Computers, on the other hand, are only capable of the first thing: they can recognize individual words and phrases, but they don't really understand speech in the same way humans do.

Speech recognition is still useful, however, because we don't need computers to actually carry on conversations with us — we just need to give them commands. When you type a word or phrase, the computer doesn't actually understand English, but it recognizes the command and software tells the computer what to do when that command is recognized.

The same is true of speech recognition software. Users speak commands that are recognized by a piece of software called the speech engine. The speech engine then tells the speech application what the user said, and the application determines what to do next.

In speech applications such as dictation software, the application's response to hearing a recognized word may be to write it in a word processor. In an interactive voice response system, the speech application might recognize a person's name and route a caller to that person's phone.



Speech recognition is also different from voice recognition, though many people use the terms interchangeably. In a technical sense, voice recognition is strictly about trying to recognize individual voices, not what the speaker said. It is a form of biometrics, the process of identifying a specific individual, often used for security applications. Because we all have distinct speaking styles — computers can take a sample of speech and analyse it for distinct characteristics, creating a “voice print” that is unique to an individual in the same way a fingerprint is. A common voice recognition system might make the user speak a password. It would then compare the speaker’s voice print to a stored voice print and authenticate the user if they matched. Though speech recognition uses some of the same fundamental technology as voice recognition, it is different because it does not try to identify individuals. Rather it tries to recognize what individuals say. It’s the difference between knowing who is speaking and what is said.

Though they vary greatly, speech engines generally use a similar process to figure out what a speaker said. The engine loads a list of words to be recognized. This list of words is called a grammar. The engine also loads audio from the speaker. This audio is represented as a waveform, essentially the mathematical representation of sound. The engine compares the waveform to its own acoustic models. These are databases that contain information about the waveforms of individual sounds and are what allow the engine to recognize speech. The engine compares the words in the grammar to the results it obtained from searching its acoustic models. It then determines which words in the grammar the audio most closely matches and returns a result.

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### **AUGMENTED REALITY SYSTEMS**

What is "Augmented Reality"? Abbreviated as AR, Augmented Reality is virtual reality added to real imagery, imagine a camcorder where as you look through the viewfinder, you see some computer generated 3D objects drawn on top of the video picture. For example virtual chess pieces could be drawn on top of an empty chess board. The computer must know where the camcorder is relative to the chess board in order to know how to "augment" the image correctly. One way to achieve this is to put marker patterns in the scene, when this marker is recognized in the camera image, the computer rendering the virtual chess pieces knows what position and angle to render them and draw them over the camera image so that it appears natural to you looking through the viewfinder.

A more concise definition is: Augmented Reality (AR), also known as "Mixed Reality" is where virtual and real objects appear together in a real time system. Today Augmented Reality is used in entertainment, military training, engineering design, robotics, manufacturing and other industries.

ARTag is an "Augmented Reality" system where virtual objects, games, and animations appear to enter the real world. 3D graphics is added in real time to video, similar to "view matching" in Hollywood, except that with Augmented Reality it is happening online. ARTag "Magic Lens" and "Magic Mirror" systems use arrays of the square ARTag markers added to objects or the environment allowing a computer vision algorithm to calculate the

camera "pose" in real time, allowing the CG (computer graphics) virtual camera to be aligned. This gives the illusion of 3D animations or video games to appear to belong in the real world.

AR requires aligning a virtual camera with the real one, and overlaying or combining the imagery for both, to be displayed on some computer monitor, hand-held or wearable display. Tracking the real camera pose is a fundamental part of AR. The system can be simplified if computer vision is used to find the camera pose, instead of some expensive specialized external sensors (acoustic, LED, RF, magnetic). AR is increasingly becoming a field where computer vision and graphics meet. ARTag is a system that uses computer vision and markers to achieve AR using just a video or webcam. It uses complex image processing and digital symbol processing to achieve a higher reliability and immunity to lighting.

There are two ways to use ARTag AR: "Magic Lens" and "Magic Mirror". With a "Magic Lens", a user holds a tablet PC, PDA, or camera cell phone (or any computer device with a display and camera) and looks "through" it to see the mixture of real and virtual reality. A Magic Lens system is mostly a private experience, every user needs their own hardware, whereas in a "Magic Mirror" system a single video camera looks out from near a large screen and users see their "reflection" with 3D content added.

AR with the "Magic Lens" metaphor brings 3D computer data into the real world instead of forcing humans to go into the computer world, moving a camera, object, or tablet PC/PDA around is more intuitive than learning key and mouse actions to move around a virtual environment.

As far as I'm concerned AR is the technology that will be developed in the nearest future as the best way to bring a computer vision in our everyday life. It is still very difficult to come across this technology but it has a great potential. AR systems can help to solve lots of tasks what previously was impossible to do.

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## **GOOGLE ANDROID OS DEVELOPMENT FUNDAMENTALS**

### **1. Short platform overview. Main system components**

Android is open-source software stack for mobile devices initially developed by Android Inc based on modified version of the Linux kernel. Since 2005 it is owned by Google Inc. Google

Android has own application framework, Dalvik virtual machine (optimized for mobile devices), integrated web browser engine, mobile-optimized 2D and 3D graphics libraries (based on the OpenGL ES 1.0), SQLite structured data storage and a lot of other features for using hardware, accessing location information, running background services, setting alarms, adding notifications to the status bar etc.

### **2. Platform architecture levels**

- Applications level: core and user applications including written using the Java programming language.
- Application Framework level: set of services and systems for different app needs.
- Libraries and runtime: Virtual machine, System C library, Media Surface Manager, graphics libraries, rendering libraries, SQLite etc.

- The Dalvik VM relies on the Linux kernel for underlying functionality such as threading and low-level memory management.

- Linux modified kernel

### **3. Android framework. Typical Android app structure**

Android applications are written in the Java programming language. The compiled Java code is bundled by the aapt tool into an Android package(.apk).

The manifest is necessary structured XML file named AndroidManifest.xml which declares the application's components, such as naming any libraries the application needs to be linked; identifies access permissions the application needs.

Activity is a single visual user interface, independent of the others. Each one is implemented as a subclass of the Activity base class. The visual content of the window is provided by a hierarchy of views — objects derived from the base View class.

A service runs in the background for an indefinite period of time. Each service extends the Service base class. Services run in the main thread of the application process.

Broadcast receiver component receives and reacts to broadcast announcements. Applications can also initiate broadcasts - all receivers extend the BroadcastReceiver base class.

Content provider makes a specific set of the application's data available to other applications. Data can be stored in the file system, in an SQLite database etc. The content provider extends the ContentProvider base class.

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## **THE METHOD OF ROUTING IN THE MOBILE COMPUTER NETWORKS**

Mobile computer networks have the notable capability of enabling spontaneous networks. These networks are self-initializing, self-configuring and self-maintaining, even though the underlying topology is often changing continually. It is important to prepare for a widespread usage of these networks, because research has only begun to scratch the surface of the potential applications of this technology.

Computer networks of large dimensions are characterized by multilevel routing. Routing protocols that are used in modern mobile computer networks are effective in a small number of nodes and low mobility. If you increase the size of a network and the mobility of nodes and we use this class of protocols that dramatically increases the amount of service traffic, the time of formation routes and computational complexity of routing algorithms. Most of known methods and routing protocols in mobile networks are designed for networks with an uniform structure (for example, Wireless Routing Protocol) or for networks with fixed-band structure, that is not effective for large-scale mobile networks. Construction of a hierarchical network will provide an opportunity to carry out the routing procedure separately for intra-and interband levels, due to what the amount of service information transmitted over the network can be significantly reduced.

Effective usage of existing methods and routing algorithms in modern computer networks depends on the structure and dimensionality of the network. The requirements of intelligent routing protocols must be taken into account. These will ensure the information

transfer against given parameters of service quality with minimal service traffic regardless of network reconfiguration. In connection with, the mobile network topology changes dynamically, which makes impossible to use conventional routing tables. Therefore, decentralized protocols multilevel dynamic routing are used in mobile computer networks large-scale, which suggests a partition of the network to routing zone. In this case, the routing procedure is performed separately on intradomain (protocols RIP and OSPF) and inter-domain protocol (BGP) levels. To solve this problem it is proposed to use a Zone Routing Protocol to partition the network into zones, that are independent from each other, and Distributed Dynamic Routing algorithm for constructing a tree of nodes by periodic exchange of messages between nodes and their neighbors. Algorithm for creating the zone in ZRP begins its action since the introduction of a node is finished in the network. The network-wide interzone routing protocol actually determines routes between individual nodes, rather than just between higher level network entities.

Zone Routing Protocol was the first hybrid routing protocol with both a proactive and a reactive routing component. In this regard, depending on coherence degree value the main node is chosen (proactive method), and it organizes its own zone and saves all routing intraband information. For routes beyond the local zone, route discovery happens reactively. The source node sends a route requests to its border nodes, containing its own address, the destination address and a unique sequence number. Border nodes are nodes which are exactly the maximum number of hops to the defined local zone away from the source. The border nodes check their local zone for the destination. Consequently, the ZRP provides the most benefit in networks where reliable neighbor broadcasting is either inefficient or altogether impossible.

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## QUANTUM COMPUTERS

Over the past several decades, quantum information science has emerged to seek answers to the question: can we gain any advantage by storing, transmitting and processing information encoded in systems that exhibit unique quantum properties? Today it is understood that the answer is “yes”, and many research groups around the world are working towards the highly ambitious technological goal of building a quantum computer, which would greatly improve computational power for particular tasks.

A quantum computer is a device for computation that makes direct use of quantum mechanical phenomena, such as superposition and entanglement, to perform operations on data. The basic principle behind quantum computation is that quantum properties can be used to represent data and perform operations on these data. A theoretical model is the quantum Turing machine, also known as the universal quantum computer.

Although quantum computing is still in its infancy, some experiments have been carried out. They demonstrated that quantum computational operations were executed on a very small number of qubits (quantum bit). If large-scale quantum computers can be built, they will be able to solve certain problems much faster than any current classical computers (for example Shor's algorithm).

A single qubit can be represented by one, zero, or, crucially, any quantum superposition of these; moreover, a pair of qubits can be in any quantum superposition of 4 states, and three qubits in any superposition of 8. In general a quantum computer with  $n$  qubits can be in an arbitrary superposition of up to  $2^n$  different states simultaneously (a normal computer which can only be in *one* of these  $2^n$  states at any instant of time). A quantum computer operates by manipulating those qubits with a fixed sequence of quantum logic gates. The sequence of gates to be applied is called a quantum algorithm.

There are several reasons for why the researchers are working so hard to develop a practical quantum computer. First of all, because atoms change energy states very quickly -- much more quickly than even the fastest computer processors.

Although the quantum particle can be utilized to make computers, quantum computers are still far from becoming a reality and most of the research about them is theoretical. To date, researchers haven't been able to manipulate more than 7 qubits in solving mathematical equations. There have been some developments in this field, the most remarkable of them are: experiments in August 2000 by researchers at IBM and at Los Alamos National Laboratory.

Despite the future of quantum computing looks promising, we have only just taken our first steps to actual realizing of a quantum computer. There are many hurdles, which need to be overcome before we can begin to appreciate the benefits they may deliver. Researchers around the world are racing to be the first to achieve a practical system, a task, which some scientists think, is futile.

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### **CREDIT CARD WITH A COMPUTER INSIDE**

**Smarter card:** A user has to enter a PIN to display this card's full number and unlock its magnetic stripe for use either online or in-store. After a short time the display and magnetic stripe become blank again.

A programmable credit card can display useful information, offer added security features, and even act as several different cards by rewriting its own magnetic strip.

Two types of programmable credit cards were unveiled this week at the DEMO conference in Santa Clara, California, by Dynamics, a startup based in Pittsburgh that's been developing the technology in stealth mode for three years. The company raised \$5.7 million of funding last year.

The new cards are no bigger than the one in your wallet, and are actually slightly more flexible. It can display information at the press of a button, and can become several different cards by rewriting its own magnetic strip.

The "MultiAccount" card has two buttons on its face, each with an indicator light that can be pressed to record data to its magnetic strip. These cards are exactly the same size and thickness of a conventional card and the lithium-polymer battery inside can last four years under high usage. They're also fully waterproof, so you can put them through the washing machine.

The "Hidden" card features a keypad and black-and-white display for six of the digits in the card's unique number. Once the correct PIN is entered on the card's four buttons, the

missing digits are filled in and the card's magnetic strip is populated with data. Both the digits and the strip become blank again after a short time.

Cards with this technology have been used in large numbers in stealth trials in the U.S. since earlier this year, who adds that banking partners will begin talking about their plans for the technology in coming months. A particular attraction for banks is that the cards are compatible with existing infrastructure, unlike contactless payments based on RFID chips.

Banks already target different types of cards to particular demographics and use reward schemes to attract new business and encourage heavy use of their products. Cards with computational smarts inside could enable more of that. For example, a credit card that can suddenly act as a loyalty card might encourage customers to use a scheme that they otherwise wouldn't.

Dynamics is also working on cards that include E Ink-style displays that remain switched on for longer periods, and the company is also investigating a card that can transfer more data.

Typically only a third of the magnetic strip on a card carries the card's details. You can send messages between card and reader using the rest of that area.

In conclusion we must say that such programmable credit card will be developed in the near future. It has a great potential not just in the information technologies sphere but in the sphere of private security information. And the important role of this device is its competitiveness because there is no such devices which could be compared with it.

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## **COMPUTATIONAL VIRTUAL 3-D IMAGERY OF BIONICAL ENGINEERING MODEL OF THE STRETCHED AND COMPRESSED DNA DOUBLE HELIX**

Now, as it is seen from the previously published works, there are sufficient data for the development of geometric version of a bionical engineering model of the stretched and compressed DNA double helix.

Our bionical engineering model [1] would require a visual inspection of special features of the stretched and compressed DNA [2].

That is why the main goal of our research is the preparation of the unified geometric version of the computational virtual 3-D imagery of bionical engineering model of the stretched and compressed DNA double helix.



***Fig.1.Bionical engineering models of the double helix (I)***

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### FORMING OF IMAGE IN TELEVISION INFORMATIVE MEASURING SYSTEMS

The feature of the modern stage of development of high-tech is that for their control the telemetric systems are utilized in most cases (about 75 %), namely the television informative measuring systems (TIMS) are an optical-electronic devices, intended for forming and analysis of image.

TIMS, which give possibility to conduct the analysis of the optical fields of various origin in many points real-time with high spatial distinction, got considerable distribution in the technologically developed countries.

The main task of TIMS is forming of high-quality image. Forming of image in TIMS passes the following cycle: at first, an image is formed on the optical system, farther on a light-electric transformer (LET), the next stage of passing is a video inspection device, in same queue, an image on LET is formed as a charge package, as an aggregate of electric impulses and as a numerical matrix.

Traditionally quality of image equates high discriminability. For the estimation of discriminability are utilized different methods, among which the most perfect is consider a method based on the analysis of function of passing to modulation (FPM) and contrast of image.

Development and wide introduction of spatially frequency presentations in practice of analysis of the systems of forming and image transfer allowed to define a discriminability through FPM and some threshold level of contrast which is a stricter estimation comparatively with that, when a discriminability is determined the sizes of pixel.

For the quantitative estimations of threshold level of contrast the use of different methods is possible. So, for the normal television system take on a threshold value of initial contrast of  $K_t = 0,12$ .

A threshold contrast is determined for the set value of probability of  $P$  of registration of signal taking into account the entrance contrast of  $K_{in}$

$$K_{in} q(E) K_t = q_t(P),$$

where  $q(E)$ ,  $q_t$  – a relation signal/noise at luminosity of  $E$  and threshold.

A discriminability is determined as a value, reverse to spatial frequency on which the rationed transitivity to the contrast numeral equates with a threshold level

$$\prod_i K_i(f_{K_t}) = K_t,$$

where  $K_i(f_{Kt})$  – coefficient of transition contrast of components of device on spatial frequency of  $f_{Kt}$ , for which the rationed transitivity to the contrast of device equals the threshold contrast of  $K_r$ .

LET works in the range of liernes:

$$K_t = \frac{q_t(P)}{K_{in} q(E)}.$$

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## **SEARCHING HAMILTONIAN CYCLE IN THE DYNAMICALLY CHANGING GRAPH**

The dynamic problem of finding Hamiltonian cycle in the graph is considered in this article. We suppose that the weight of graph ribs are changing with the lapse of time. Branch and bound method, ant colony optimization (ACO) and greedy algorithms were developed in order to solve the problem. These methods give the possibility to regard this task as general type of traveling salesman problem.

One of the areas this problem can be reduced to is the problem of flights scheduling of technical service team.

*Meaningful statement of the problem:* an airline has in its disposition  $N$  planes. Every day, each plane flies to some places, ending the day at some location. The technical service team can repair only one plane per night and fly to any another place per day. The task is to determine the schedule for the technical service team in order to minimize total transport costs.

*Mathematical model:*

In order to formalize the task some variables must be lead-in:

, if the technical service team flies from city with locating plane  $i$  to  
 $j$  city with locating plane  $j$  in the day  $t$ ,  $t = \overline{1, N}$ ,  $i = \overline{1, N}$ ,  $j = \overline{1, N}$ ;

otherwise.

Objective function is considered to be minimizing the total cost of the flight of the technical service team):

$$\sum_{t=1}^N \sum_{i=1}^N \sum_{j=1}^N c_{ij}(t) x_{ijt} \rightarrow \min \quad (1)$$

$c_{ij}(t)$  – the cost of traveling from plane  $i$  to plane  $j$  in the day  $t$ .  $c_{ij}(t)$  depends on time. It is important to note that  $c_{ii}(t) = \infty$  as technical service team repairs each plane just once.

There are some important restrictions. The service team must leave and leave each plane just once. Every plane must be served.

Significantly, the solution must be a cycle.

The problem is NP-hard. ACO proved itself as the best way of solving the traveling salesman problem. This was the main reason for developing algorithm of this family. Some experiments have been carried out and allowed to define parameters that determine “gregariousness” and “greediness” of the algorithm.



Branch and bound method uses greedy algorithm at the first stage as its initial score. It successfully finds accurate solutions, but possible problem's dimension is much lower. Greedy algorithm usually doesn't give accurate answer, though it's quite simple to use and its dimension is much higher.

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## **ENSURING QUALITY OF SERVICE SET PARAMETERS FOR REAL-TIME TRAFFIC**

For today's computer networks characteristic is the presence of multiple traffic types. Each type of traffic depending on the permissible level of delays imposes its own requirements for quality of service QoS (Quality of service).

QoS is the ability to provide different priorities to different applications, users, data flows or guarantee a certain level of performance to a data flow. For example, a required bit rate, delay, jitter, packet dropping probability and/or bit error rate may be guaranteed. Quality of service guarantees are important if the network capacity is insufficient, especially for real-time streaming multimedia applications such as voice over IP, online games and IP-TV.

It is important to note that for every network application there is a feasible value of time delay in the transmission of information.

So in such situation no point to use the TS (Traffic shaping), because the packets to be transmitted with a delay will not be used, what lead us to the conclusion that we can use only polising.

TS is the control of computer network traffic in order to optimize or guarantee performance, improve latency, and/or increase usable bandwidth by delaying packets that meet certain criteria.

Today to send and receive packets at routers commonly used method of FIFO (Acronym for First In, First Out).

FIFO an abstraction in ways of organizing and manipulation of data relative to time and prioritization. This expression describes the principle of a queue processing technique or servicing conflicting demands by ordering process by first-come, first-served (FCFS) behavior: what comes in first is handled first, what comes in next waits until the first is finished.

To improve the required level of QoS, we use "smart" queue, in which the priority of a packet depends not only on the order of receipt of the queue and the type of service that is specified in the value of the field ToS (Type of Service) IP-packet.

The IP datagram header contains an 8-bit field called Type of Service. The field has been part of the IP header since the beginning, but it was rarely used until the recent introduction of Differentiated Services (Diff-Serv).

In this regard, the most effective to give high priority to real-time traffic (VoIP packets) and the low priority data traffic and transactions (batch FTP (File Transfer Protocol), SMTP (Simple Mail Transfer Protocol) clients and clients in the network that deals with file-sharing).

Due to the fact that network resources are always in short supply and get unlimited bandwidth cannot be offered to improve the quality of the incoming signal to VoIP. This can be accomplished through the use of traffic separation at upstream and downstream is. QoS downstream allows you to stream, in contrast to the rising QoS prioritize incoming traffic. In

the case of high load on the channel (for example, transmits data of a large size) downstream QoS will dynamically limit the downstream data traffic in order to free up bandwidth for connections Voice over IP.

Thus, we can achieve the most efficient way to transfer data at high load on the channel and at the same time, delays will be minimal.

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## **4G NETWORK**

A 4G network is the fourth generation of wireless communication. While still in development, the foundations for the replacement of the present network is currently being researched and constructed by the cellular phone industry and other technology developers. The overall goal for the network is to provide a comprehensive and secure Internet Protocol solution with much faster data speeds than previous generations.

The first wireless network, known as 1G, was founded during the 1980s. 2G was introduced in the early 1990s as a way of allowing more transmissions to occur per communication channel. The foundations of 3G were established in the late 1990s and have been implemented throughout the majority of the world as of the early 21st century. While the 3G network was the first to allow for multimedia applications, 4G promises to take this basic technology and amplify its usage.

The specifics of the 4G network are geared towards a higher quality of service. Better reception and less dropped data and information exchanges are a priority. The International Telecommunications Union (ITU), the organization that oversees the standards of the present wireless networks, has stated that it requires substantial improvements to multimedia messaging services, including video services, in order to approve a new generation. It wants a data speed transfer rate of at least 100 megabits per second while a user is physically moving at high speeds and a one gigabit per second data rate in a fixed position. The ITU also requires interactive roaming between networks.

In telephony, 4G is the fourth generation of cellular wireless standards. It is a successor to 3G and 2G families of standards. A 4G system is expected to provide a comprehensive and secure all-IP based solution where facilities such as ultra-broadband (giga-bit speed such as 100+ MiB/s) Internet access, IP telephony, gaming services, and streamed multimedia may be provided to users.

A variety of working groups have been established to help develop the 4G network. Proposals from these organizations include implementation of WiMax, a faster version of wireless data transfer than WiFi networks. The groups also plan to utilize packet-based information exchange based on standard IP technology. This promises to be the fastest mobile communication method without cables ever devised.

In order to make the 4G system work, the concept of smart antennas must be developed and implemented. With the establishment of the 2G and 3G networks, a number of different methods of data transmission were created. Many of these technologies can be rolled into the 4G network, however, the working groups and ITU prefer a standardized antenna system that can communicate across company lines.

One of the proposed technologies to make this happen is known as spacial multiplexing. Special multiplexing uses a series of antennas linked into a single transmitter and receiver. These antennas are capable of functioning simultaneously, speeding up the space-time data exchange rates.

The ITU plans to have the 4G network rolled out to the global market in a much more effective and timely manner. With the speeds and video technology, the possibilities for wireless communication will revolutionize the global communications network. However, concerns over stability and security are also prime factors in the

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## **CLOUD COMPUTING**

Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing storage, memory, processing.

Cloud computing comes into focus only when you think about what IT always needs: a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends IT's existing capabilities.

Cloud architecture, the systems architecture of the software systems involved in the delivery of cloud computing, typically involves multiple cloud components communicating with each other over application programming interfaces, usually web services. This resembles the Unix philosophy of having multiple programs each doing one thing well and working together over universal interfaces. Complexity is controlled and the resulting systems are more manageable than their monolithic counterparts.

The two most significant components of cloud computing architecture are known as the front end and the back end. The front end is the part seen by the client, i.e. the computer user. This includes the client's network (or computer) and the applications used to access the cloud via a user interface such as a web browser. The back end of the cloud computing architecture is the 'cloud' itself, comprising various computers, servers and data storage devices.

Cloud computing customers don't have to raise the capital to purchase, manage, maintain, and scale the physical infrastructure required to handle drastic traffic fluctuations. Instead of having to invest time and money to keep their sites afloat, cloud computing customers simply pay for the resources they use, as they use them. This particular characteristic of cloud computing—its elasticity—means that customers no longer need to predict traffic, but can promote their sites aggressively and spontaneously. Engineering for peak traffic becomes a thing of the past.

The Cloud model has been criticized by privacy advocates for the greater ease in which the companies hosting the Cloud services control, and thus, can monitor at will, lawfully or unlawfully, the communication and data stored between the user and the host company. Instances such as the secret NSA program, working with AT&T, and Verizon, which recorded over 10 million phone calls between American citizens, causes uncertainty among privacy

advocates, and the greater powers it gives to telecommunication companies to monitor user activity. While there have been efforts (such as US-EU Safe Harbor) to "harmonize" the legal environment, providers such as Amazon still cater to major markets (typically the United States and the European Union) by deploying local infrastructure and allowing customers to select "availability zones."

Today, with such cloud-based interconnection seldom in evidence, cloud computing might be more accurately described as "sky computing," with many isolated clouds of services which IT customers must plug into individually. It's a long-running trend with a far-out horizon. But among big megatrends, cloud computing is the hardest one to argue with in the long term.

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**GVS1000 LONG RANGE IMAGING SYSTEM**

In our article we are going to tell you about new generation of long range imaging system. The GVS1000 is a system designed for long range, day/night, pan-tilt-zoom surveillance. The system delivers 1 km of recognition-level performance and 1200 m (3900 ft) of classification-level performance in total darkness. The GVS1000 provides long range 24/7 imaging for critical applications such as port and maritime monitoring, transportation and airport surveillance, and border and extended perimeter security. To effectively perform to such capabilities, the GVS1000 is equipped with an Infra-Red (IR) -corrected long range lens capable of 60x optical zoom. With a focal length of 12.5\*750 mm or 25\*1500 mm (with doubler function engaged) the lens works together with the high performance Dinion XF sensor to produce ultra-high quality images at far distances in day and night conditions. System capability is greatly enhanced due to using active IR illumination. Two sets of illuminators are provided: one for long range and one for medium-to-short range night imaging. There are no safety concerns as is the case with laser-based units. IR illumination can be controlled manually or set into automatic mode for auto on/off function via a photocell. For controlling the GVS1000 is compatible with Pelco P/D protocols via RS422/RS485 and Bosch Biphas.

Level	Distance	Description
Classification	1,200 m (3,900 ft)	Performance level at which an object is determined to be human as opposed to an animal or other object.
Recognition	1000 m (3,300 ft)	Performance level at which a human-sized object is determined to be a threat or non-threat based on the type of clothing worn, equipment carried, etc.(friend or foe).
Identification	500 m (1,650 ft)	Performance level at which a human target can be identified as a specific individual.

The main functions of optics, IR and PT monitor are IR-corrected 60x optical zoom for night vision beyond 1.2 km, best-in-class Dinion XF imaging performance, long range

ZX700 IR illumination, medium/short range IR provided by dual BDS208DS with Black Diamond technology, variable speed and highly precise motor drive in pan and tilt, preset and tour functionality with hard and soft limits. The characteristics of night-time performance range (under optimal conditions) are shown in the table below.

So this product, which is produced by "Bosch", has very big chances to become the leader of world's long range imaging systems. We consider GVS1000 long range imaging system as such does not have analogue in the world and also it obtains very interesting and progressive characteristics which as we have already mentioned make it the leader in its sphere.

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## **FEATURES OF MICROSOFT FOUNDATION CLASSES**

The Microsoft Foundation Class Library (also Microsoft Foundation Classes or MFC) is a library that wraps portions of the Windows API in C++ classes, including functionality that enables them to use a default application framework. Classes are defined for many of the handle-managed Windows objects and also for predefined windows and common controls.

MFC was introduced in 1992 with Microsoft's C/C++ 7.0 compiler for use with 16-bit versions of Windows as an extremely thin object-oriented C++ wrapper for the Windows API. C++ was just beginning to replace C for development of commercial application software at the time.

One interesting quirk of MFC is the use of "Afx" as the prefix for many functions, macros and the standard precompiled header name "stdafx.h". During early development what became MFC was called "Application Framework Extensions" and abbreviated "Afx". The name Microsoft Foundation Classes (MFC) was adopted too late in the release cycle to change these references.

Microsoft Foundation Classes can be categorized into ten classes. They are Root class, MFC Application architecture classes, Window Dialog and Control Classes, Drawing and Printing classes, Simple Data Type classes, Arrays, List and Map classes, File and Database classes, Internet and Networking classes, OLE classes, and Debugging and Exception classes. CObject is the base class or the mother of all Microsoft Foundation Classes. CObject provides various useful capabilities to all the classes derived from it, with very low overhead. CRuntime class does not have any base class. CRuntime class is used to obtain information about an object or its base class at runtime.

Operation system takes interrupts , which are being generated by user or by other application software. It sends these interrupts to our application in form of message, which contains information about system changing. That's mainly about mouse moving, clicking, pushed buttons. We obtain this information in comfortable form to process it. There is a work of API to create these messages. In MFC we even don't need message processing, that's all is done by MFC.

There are different View classes for all cases of our life. CEdit presents easy editing polystrings text, includes finding with replacement and printing. CFormView is a form presentation. It's a dialog window, which manages data presentation and user input. It's the same functionality, which presents in Windows Forms for CLR.

CHtmlView - presentation for viewing HTML pages.

CHtmlEditView – Extend of CHtmlView, page editing added.

CListView – allows to use “document – presentation” architecture, with list elements.

CView – base possibilities for documents view.

CScrollView – added scroll to Cview.

CTreeView – allow to use architecture with tree view control elements.

Last updates to the library include many enhancements that allow your applications to have the look of the latest Office 2007 user interfaces (including the Office Ribbon). Additionally, you can give your application docking toolbars and panes for the look of Visual Studio.

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## **LONG TERM EVOLUTION**

3GPP Long Term Evolution (LTE) is the latest for today standard in the mobile network technology which is a continuation of the standards GSM/EDGE and UMTS/HSPA. It is a project of the 3rd Generation Partnership Project (3GPP). A 4th generation standard (4G) of radio technologies is designed to increase the capacity and speed of mobile telephone networks. Part of the LTE standard is the System Architecture Evolution, a flat IP-based network architecture designed to replace the GPRS Core Network and ensure support for, and mobility between, some legacy or non-3GPP systems, for example GPRS and WiMax respectively.

The LTE specification provides downlink peak rates of at least 100 Mbit/sec, an uplink of at least 50 Mbit/sec and RAN round-trip times less than 10 milliseconds. It should be noted that this rate can be increased through the use of technology MIMO (Multiple Input Multiple Output), which is a method of forming a communication channel with multiple antennas. As an example for a system with 4 transmitting and 4 receiving antennas (4x4) data transfer rate can be increased to 326.4 Mbit/sec, using the same frequency band 20MHz. LTE supports scalable carrier bandwidths, from 1.4 MHz to 20 MHz and supports both frequency division duplexing (FDD) and time division duplexing (TDD). The main advantages with LTE are high throughput, low latency, plug and play, FDD and TDD in the same platform, an improved end-user experience and a simple architecture resulting in low operating costs. LTE will also support seamless passing to cell towers with older network technology such as GSM, cdmaOne, UMTS, and CDMA2000.

One of the main differences between LTE system in contrast to previous technologies is entirely new air interface with a fully modified method of signal modulation. In the LTE system the access technology OFDMA is used for direct channels, and SC-FDMA technology is used for return channel. This difference will achieve spectral efficiency (transmission rate for 1 Hz) for downlink - 5 Mbit/sec/ Hz, and uplink 2.5 Mb/sec/Hz. Covering radius of the base station LTE may be different, depending on the power and frequency used. Under normal conditions it is about 5 km, but if necessary it may take up to 30 km or even 100 km (with sufficient lifting the antenna).

Regarding the prospects for the deployment of LTE network in Ukraine, depends on use of radio frequency resource of NCRC. However, the existing mobile operator MTS has signed an agreement with Alcatel-Lucent on cooperation in the development of services based on technology LTE.

## **AUGMENTED REALITY**

Augmented reality is an environment that includes both virtual reality and real-world elements at the same time. In other words, it is a combination of the real scene viewed by the user and a virtual scene generated by the computer that augments the scene with additional information. That's what from the name came.

Furthermore, virtual reality objects of this environment can be stationary or manipulated, depending on purposes which are set.

Surprisingly or not, this technology found widespread usage in different areas: such as making films, games, books, in education, training, medicine, engineering, manufacturing, navigation and simply in our everyday life.

Augmented reality became very popular: the last most amazing and, in addition, successful films as Avatar and District 9, different interactive advertisements have already appeared of such giant companies as Coca Cola, Pepsi, new era of games for WII and XBOX and others, thousands of applications for mobile phones, the most well-known are Google goggles, Toozla, using that with the help of camera you can get additional information about any object that surrounds you ( just imagine: paintings, buildings, streets, roads, cars, shops, products, events, etc. and even you can direct the camera to the night sky with stars and it will recognize constellation and show you its name and information about it(of course, if needed software is installed)), magazines, books and newspapers with special barcodes that can be turned into virtual reality elements and give special information or entertainment videos or images, different kinds of training, when you see some object and additional virtual elements help you to understand what you have to do with it to reach a specific result(it is already used by BMW company for automobile building and repairing) in medicine most of operations are made using screen that shows the state of the patient (his vital signs) besides the video of his/her organs , all these things became able due such a marvelous technology.

This list makes it more impressive that many of these achievements were made in the last couple of years.

Also augmented reality found its applying in special systems, that contain such basic elements as camera, smart phone, mirror, projector.

Of course, the simplest variants of augmented reality systems can contain only a smart phone and a camera.

Camera and mirror examine surrounding world feeding the image to smart phone which processes received information and projector turns any kind of surface into an interactive screen.

Augmented reality is full of criticism. Lost of privacy, easy methods of information hacking, bad influence on children whose will know things that their psychic is not ready to perceive. But you are probably kidding! We'll get much more advantages than disadvantages with that technology – people just need to use it wisely.

Moreover, an actual rate of augmented reality is the forth place in the Top 10 tech trends for 2010.

The future of augmented reality is clearly bright, this environment will certainly be developed and solve a lot of problems today`s systems have and undoubtedly change our usual boring life and make the world more informative.

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## **INFORMATION SECURITY**

Information security is an essential personal as well as business concern. As a outcome of using the internet for online banking and shopping, recorded information is stored in several places, including bank accounts, store accounts, and medical accounts. While it is essential to trust the businesses and other organizations with personal data, customers / owners have a responsibility to maintain and safe their identity and information.

Identification theft is one of major and most seriously damaging breaches of safety that individuals and businesses can experience. All kinds of business transactions, including taking out loans, purchasing products, and getting cash out of bank accounts, can be the result of a stolen identity.

Businesses have particular areas of data which need to be secure. A primary set of data is that of customers and this needs to be the primary priority for any type business. Customers let their priorities be known by where they do business and data security is a main concern for many.

Protecting information about products, whether new or existing, is really a priority for several industries. Competing businesses may be looking to get ahead with new and innovative products and stolen data may present that opportunity. Companies also keep comprehensive employee information including Social Security Numbers, telephone numbers, addresses and employment records and it is vital to their company`s success to protect information about employees and their reputations.

An amazing amount of data is stored on individual and business computers and their vulnerability to viruses, systems crashes, human error, hackers and natural disasters cannot be overlooked nor the need for computer protection always being updated. One way to protect against the possibility of losing vital information stored on a computer would be to have sufficient and reliable backup and this can be done by copying files to back-up discs and then storing them in a fireproof safe.

It is essential for information security to make sure that the anti-virus software on the computer is up-to-date and that the anti-virus program has back-up protection built into the software. Firewalls will also prevent illegal customers from hacking into a computer system and stealing private information.

Secured passwords are an additional way to ensure information security on the computer, particularly when logging in. All passwords should have a combination of numbers and letters which are challenging to figure out.

Information security is the responsibility of everyone both at home and at work.



## **USING ELEMENTS OF ARTIFICIAL INTELLIGENCE SYSTEMS FOR DEVELOPING CORPORATE MARKETING STRATEGY**

Nowadays specialists at development and modeling of marketing strategy face with a sharp problem of a lack of human and time resources.

Development of marketing strategy for the companies occupies very long time and demands involving of a large quantity of specialists: experts in marketing, technologists, specialists on PR, auditors and economists and etc.

Therefore at certain stages it is offered to automate completely the process of marketing strategy development, and at some stages to make it partial.

For the decision of the given problem the algorithm, which will be taken subsequently as a principle a certain difficult system, with use of artificial intelligence elements (namely neural networks), is created.

For realization conceived algorithms, which have been developed for creation of environment system in a computer game "S.T.A.L.K.E.R", are partially used. These algorithms, being unique by the ideological nature, also represent an interesting material.

It is necessary to notice that the received algorithm can be used also in many other spheres where fast and reliable data analysis is required.

As an example of algorithm work the activity of HR-department, namely a task in view of forming the list of questions for interviewing candidates for different vacancies have been chosen. As alternative decisions have been offered the results received by means of a neural network «Statistical Neural Networks». In the conducted research neural technologies have allowed to select from the number of questions set in questionnaires, the most essential. Then it became possible to remove insignificant, duplicated and strongly correlated questions, thereby to simplify the questionnaire and to facilitate (so, and to raise accuracy) process of filling the questionnaire by the candidate.

At the first stage of carrying out estimation of structure and a content of the questionnaire for the purpose of its optimization, the basic attention was given to the importance of each problem in terms of questionnaire informativeness as a whole, for detecting problems strongly correlating among themselves, for the purpose of elimination of duplicating information.

At the second stage outcomes of the first stage work have been checked up in practice, recommendations of the first stage are fulfilled and the oblate complex of problems with the minimum loss of the information at elimination of the whole enumeration of the problems was offered, allowing maximum to raise efficiency of inquiry for the purposes put before it and to check up the logic of process in practice.

Authors suppose that the designed algorithm can raise quality, a decision making velocity in the sphere of corporate marketing strategy development.

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## **PROGRAMMABLE MATTER**

**Programmable matter** refers to matter which has the ability to change its physical properties (shape, density, moduli, optical properties, etc.) in a programmable fashion, based upon user input or autonomous sensing. Programmable matter is thus linked to the concept of a material which inherently has the ability to perform information processing.

Programmable matter is a term originally coined in 1991 by Toffoli and Margolus to refer to an ensemble of fine-grained computing elements arranged in space. When nanotechnologies and technologies of semi-conductor materials and self-replicating cars have reached certain level, the term «a programmed matter» has changed, as absolutely new possibilities have opened. It is accessible to construct such sets of elements, which can be programmed, for changing their physical properties at real conditions.

The first steps in this new technological era were made with creation of nanorobot, consisting of one molecule, created in 2006 group of scientists of the Jewish university in Jerusalem under the direction of Itamar Villner. This robot is programmed in such a way, that in case of meeting with necessary DNA robot starts to be shining. The scientists consider that in future it will be one of methods for diseases diagnostics.

Itamar Villner is known in the scientific world thanks to the invention of first molecular calculator, which uses enzymes for its operations. The fermental computer is capable to make only two basic logic operations, but such operation requires some minutes. But developers consider that this primitive molecular calculator will give them possibility to watch the reaction of an organism, caused by medicines.

Robotics-based approaches:

**1. Self-Reconfiguring Modular Robotics** is a field of robotics in which a group of basic robot modules work together to dynamically form shapes and create behaviours suitable for many tasks, for example: 1. Most important is the incredible flexibility that comes from the ability to change the physical structure and behavior of a solution by changing the software that controls modules. 2. The ability to self-repair by automatically replacing a broken module will make SRCMR solution incredibly resilient. 3. Reducing the environmental foot print by reusing the same modules in many different solutions.

**2. Claytronics** is an emerging field of engineering concerning reconfigurable nanoscale robots ('claytronic atoms', or catoms) designed to form much larger scale machines or mechanisms. The catoms will be sub-millimeter computers that will eventually have the ability to move around, communicate with other computers, change color, and electrostatically connect to other catoms to form different shapes.

**3. Cellular automata** are a useful concept to abstract some of the concepts of discrete units interacting to give a desired overall behavior.

**4. Quantum wells** can hold one or more electrons. Those electrons behave like artificial atoms which, like real atoms, can form covalent bonds, but these are extremely weak. Because of their larger sizes, other properties are also widely different.

## **MULTIPURPOSE COMMUNICATION UTILITY SHED K-1501**

In connection with the development of information technologies in the world a requirement grows of creation of a new of military unit. And Ukraine pays a special attention to this problem. Every year a new of wireless stations is produced and antenna devices, switchboards, vehicle communication units and other inventions are developed. In this article I am going to outline one new product in Military Forces of Ukraine which was recently added to our armoury.

It is Multipurpose Communication Utility Shed K-1501. This utility shed is intended for providing of radio relay communication, wire communication; automatic dial switching and routing of digital streams between Integrated Communication Facilities of control centre, between the communication centres of the control point of higher and subordinate headquarters; organizing (deployment) user networks of telephone communications and data transmission; communications network management; providing of telecommunication services to operational staff on the control post of all Armed Forces administration units, other military formations and special assignment of law-enforcement bodies in all kinds of battle, special operation, and also under the peacetime conditions along the channels, which are formed by different communication facilities.

Multipurpose Communication Utility Shed provides:

- functioning of Operator's Automated Workplace of control apparatus that fitted with official telephone communication equipments, protected by personal computer and corresponding software;
- possibility of connection with the field (mobile) and stationary complexes of apparatus for the automatic control of armed forces and ensures intercommunication at the control posts;
- deployment and possibility of simultaneous working of four radio relay communication lines between Integrated Communication Facilities and Command Post automation;
- deployment of two directions of wire communication lines with using symmetrical main cable type P-296 between Control Post's Integrated Communication Facilities, command purpose vehicle on BMP-1 base;
- deployment of two directions with the use of field fibber-optic cable;
- possibility of security for batch flows by wire and by radio relay communication lines with installing of group classifying digital equipment sets into the instrument room according additional requirement;
- deployment on Control Post the user telephone network with capacity: up to forty eight analogue two wire telephone sets with the tone of pulse collection, up to forty eight digital ISDN telephone sets;

Familiarizing with the description of this utility shed, I would like to notice, that it is intended for work with digital signals. However, it is a stride forward in the development of military technologies because all communication units, which had worked before, used analogue signals only. The digital signal has the big advantage before analogue, it works faster

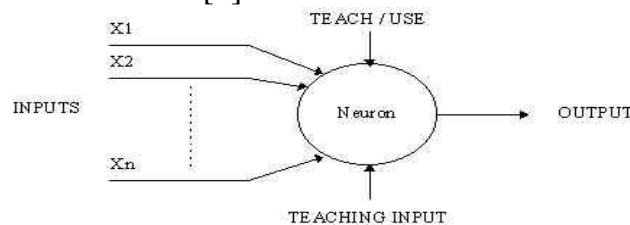
and more precisely transfers a signal phase. These advantages can play a pivotal role in the organisation of communication during carrying out of fighting operations.

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## ARTIFICIAL NEURAL NETWORKS

**Artificial Neural Networks** (ANNs) are a connectionist processing model inspired by the architecture of real brains. Artificial neural networks are composed of simple nodes called artificial neurons or Processing Elements (PEs). ANNs, like people, learn by example. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process [1].

The word **network** in the term 'artificial neural network' refers to the inter-connections between the neurons in the different layers of each system. The most basic system has three layers. The first layer has input neurons which send data via synapses to the second layer of neurons and then via more synapses to the third layer of output neurons. More complex systems will have more layers of neurons with some having increased layers of input neurons and output neurons. The synapses store parameters called "weights" which are used to manipulate the data in the calculations [2].



**A simple neuron**

Neural networks, with their remarkable ability to derive meaning from complicated or imprecise data, can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. A trained neural network can then be used to provide projections given new situations of interest and answer "what if" questions [3]. Other advantages include:

- **Adaptive learning:** An ability to learn how to do tasks based on the data given for training or initial experience.
- **Self-Organisation:** An ANN can create its own organisation or representation of the information it receives during learning time.
- **Real Time Operation:** ANN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
- **Fault Tolerance via Redundant Information Coding:** Partial destruction of a network leads to the corresponding degradation of performance

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## **ZIGBEE WIRELESS STANDARD**

ZigBee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless M2M (Machine-to Machine) networks. The ZigBee standard operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868 MHz

The 802.15.4 specification upon which the ZigBee stack operates gained ratification by the Institute of Electrical and Electronics Engineers (IEEE) in 2003. The specification is a packet-based radio protocol intended for low-cost, battery-operated devices. The protocol allows devices to communicate in a variety of network topologies and can have battery life lasting several years.

The ZigBee protocol has been created and ratified by member companies of the ZigBee Alliance. Over 300 leading semiconductor manufacturers, technology firms, OEMs and service companies comprise the ZigBee Alliance membership. The ZigBee protocol was designed to provide an easy-to-use wireless data solution characterized by secure, reliable wireless network architectures.

The ZigBee protocol is designed to communicate data through hostile RF environments that are common in commercial and industrial applications.

ZigBee protocol features include:

- Support for multiple network topologies such as point-to-point, point-to-multipoint and mesh networks
- Low duty cycle – provides long battery life
- Low latency
- Direct Sequence Spread Spectrum (DSSS)
- Up to 65,000 nodes per network
- 128-bit AES encryption for secure data connections
- Collision avoidance, retries and acknowledgements

A key component of the ZigBee protocol is the ability to support mesh networking. In a mesh network, nodes are interconnected with other nodes so that multiple pathways connect each node. Connections between nodes are dynamically updated and optimized through sophisticated, built-in mesh routing table.

Mesh networks are decentralized in nature; each node is capable of self-discovery on the network. Also, as nodes leave the network, the mesh topology allows the nodes to reconfigure routing paths based on the new network structure. The characteristics of mesh topology and ad-hoc routing provide greater stability in changing conditions or failure at single nodes.

ZigBee enables broad-based deployment of wireless networks with low-cost, low-power solutions. It provides the ability to run for years on inexpensive batteries for a host of monitoring and control applications. Smart energy/smart grid, AMR (Automatic Meter Reading), lighting controls, building automation systems, tank monitoring, HVAC control, medical devices and fleet applications are just some of the many spaces where ZigBee technology is making significant advancements.

In computer programming, unit testing is a method by which individual units of source code are tested to determine if they are fit for use. A unit is the smallest testable part of an application. In procedural programming a unit may be an individual function or procedure. Unit tests are created by programmers or occasionally by white box testers. Unit Testing cannot be expected to catch every error in the program: it is impossible to evaluate every execution path in all but the most trivial programs. The same is true for unit testing. Additionally, unit testing by definition only tests the functionality of the units themselves. Therefore, it will not catch integration errors or broader system-level errors (such as functions performed across multiple units, or non-functional test areas such as performance). Unit testing should be done in conjunction with other software testing activities. Like all forms of software testing, unit tests can only show the presence of errors; they cannot show the absence of errors.

Software testing is a combinatorial problem. For example, every boolean decision statement requires at least two tests: one with an outcome of "true" and one with an outcome of "false". As a result, for every line of code written, programmers often need 3 to 5 lines of test code. This obviously takes time and its investment may not be worth the effort. There are also many problems that cannot easily be tested at all – for example those that are nondeterministic or involve multiple threads. In addition, writing code for a unit test is as likely to be at least as buggy as the code it is testing.

To obtain the intended benefits from unit testing, rigorous discipline is needed throughout the software development process. It is essential to keep careful records not only of the tests that have been performed, but also of all changes that have been made to the source code of this or any other unit in the software. Use of a version control system is essential. If a later version of the unit fails a particular test that it had previously passed, the version-control software can provide a list of the source code changes (if any) that have been applied to the unit since that time.

It is also essential to implement a sustainable process for ensuring that test case failures are reviewed daily and addressed immediately. If such a process is not implemented and ingrained into the team's workflow, the application will evolve out of sync with the unit test suite, increasing false positives and reducing the effectiveness of the test suite.

Unit testing is the cornerstone of Extreme Programming, which relies on an automated unit testing framework. This automated unit testing framework can be either third party, e.g., xUnit, or created within the development group.

As the power of modern computers grows alongside our understanding of the human brain, we move ever closer to making some pretty spectacular science fiction into reality. Imagine transmitting signals directly to someone's brain that would allow them to see, hear or feel specific sensory inputs. Consider the potential to manipulate computers or machinery with nothing more than a thought.

One of the biggest challenges facing brain-computer interface (BCI) researchers today is the basic mechanics of the interface itself. The easiest and least invasive method is a set of electrodes - a device known as an electroencephalograph (EEG) - attached to the scalp. The electrodes can read brain signals. However, the skull blocks a lot of the electrical signal, and it distorts what does get through. Regardless of the location of the electrodes, the basic mechanism is the same: The electrodes measure minute differences in the voltage between neurons. The signal is then amplified and filtered. In current brain-computer interface systems, it is then interpreted by a computer program, although you might be familiar with older analogue encephalographs, which displayed the signals via pens that automatically wrote out the patterns on a continuous sheet of paper. In the case of a sensory input BCI, the function happens in reverse. A computer converts a signal, such as one from a video camera, into the voltages necessary to trigger neurons. The signals are sent to an implant in the proper area of the brain, and if everything works correctly, the neurons fire and the subject receives a visual image corresponding to what the camera sees.

One of the most exciting areas of BCI research is the development of devices that can be controlled by thoughts. Some of the applications of this technology may seem not serious, such as the ability to control a video game by thought. If you think a remote control is convenient, imagine changing channels with your mind. For example The Neural Impulse Actuator (NIA) is a brain-computer interface device developed by OCZ Technology. Control over the computer in either desktop or gaming environments is done by binding keys to different zones within as many as three vertical joysticks. Each joystick can be divided into several zones based on thresholds and each zone within each joystick can be bound to a keyboard key. Each key stroke can further be assigned to several modes, including single keystroke, hold, repeat and dwell which allows full plasticity with respect to configuration of the NIA for any application. Moreover, the same "vertical joysticks" can be used in more than one instance to enable simultaneous pressing of multiple keys at any given time like "W" and "Spacebar" for jumping forward or toggling between left and right strafing for running in a zigzag pattern.

Although the basic principles behind brain-computer interfaces are comprehensible, they don't work perfectly. Future studies must be directed on using the symbiosis of functional Magnetic Resonance Imaging (fMRI) and EEG technologies. As the computational power of computers increases, it may be possible to create suitable models of actions, controlled by thoughts, for different situations, using statistical analyzing time-frequency representation of magnetoencephalographic data. As for BCI-based devices, the effort should be done on wireless methods of scanning brain impulses and reduction of noise hindrance. In conclusion, the further researches in the area of brain-computer interfaces may open a new way of easy and quick controlling of various devices only by thoughts. And this can be very helpful for people with limited possibilities.

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## **DIGITAL SOUND AMPLIFIERS – NEW WAY IN SOUND ELECTRONICS**

Sound amplifiers are of great importance in our life. We hear music at home, at concerts or admire the power of sound in the cinema. Analogue amplifier was created long time ago and remain the single type of such devices until present. It appeared almost simultaneously

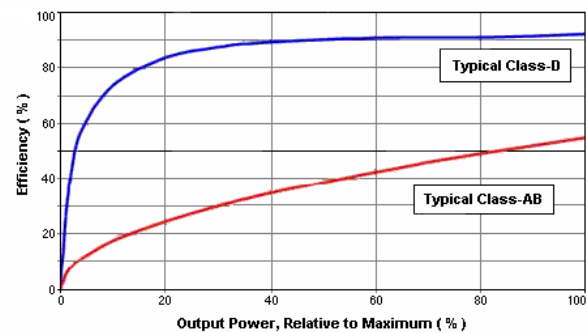
with the creation of the radio tube. But the main problem of these devices in all times was the quality of sound and low efficiency.

In spite of full integration of digital devices into our life, sound amplifying was performed with analogue amplifiers almost till nowadays. But now digital technology is forcing out the last analogue device from the sound reproduction chain. It is happening because digital amplifiers have such advantages as small gross geometry, high efficiency and low cost.

Analogue amplifier principles of operation are simple – input sound signal is enhanced without changing of its form. Electrical current in power sound transistor is operated by weak input signal. Actually, we linearly change the scale of sound signal. In such case feeding quality is the major problem (especially for power concerts equipment) and the need to create special complicated parts of amplifier's electrical circuit for input current correction increases. The next problem is transistor noise, maximum theoretical efficiency lower than 78% and intermodulation distortion.

In class D amplifiers pulls to width modulation (PWM), pulls to density modulation (PDM), sliding mode control and discrete-time forms of modulation like delta-sigma modulation can be realized. PWM is usually used for digital amplifiers. It provides sound waveform amplitude to be transformed into the width of electrical pulse. In this case high sampling frequency is used (about 250 kHz), it allows avoiding high frequency impact. Then, this ultrahigh-frequency carrier must be removed in low-frequency filter. Such principle of work allows transistor to operate (usually unipolar transistor) in key mode. As a result, very high efficiency, theoretically 100% and about 90% in practice can be obtained. At the same time this schema doesn't require the special quality of feeding. This fact allows simplifying the construction of one of the most important and valuable factors in amplifiers – power supply. In addition, using toroidal coil power unit provides us with smaller and cheaper amplifiers than it was before. Also high efficiency gives good possibility to simplify cooling unit and the whole construction.

Nowadays you can find digital amplifiers everywhere without any difference of place and device – technics that used in the home or professional devices for cinema, concerts etc. Some bands and artists bring 15-20 tonnes of music equipment, but new digital devices are being used more and more. The Crest Audio CD-3000, for sample, is a class D power amplifier that is rated at 1500 watts per channel, yet it weighs only 21 kg (instead of 30 and more). The increase of popularity along with constant lowering of price and creating of new designs favour to efficiency competing on the world market. Small geometry, unpretentious for supply (which is very important for professional's studies and concerts equipment) and high sound quality made this new kind of devices very promising and quickly integrated into our life.



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### **INFORMATION TECHNOLOGIES EVERYWHERE**

We use the term information technology or IT to refer to an entire industry. In actuality, information technology is the use of computers and software to manage information.



Not long ago the IT department might have consisted of a single computer operator, who might be storing data on magnetic tape, and then putting it in a box down in the basement somewhere. Today IT department would use computers, servers, database management systems, and cryptography to protect information.

Modern information technologies mostly are everywhere. Firstly let's talk about education. New and emerging technologies challenge the traditional process of teaching and learning, and the way education is managed. Rapid communication, plus increased access to IT in the home, at work, and in educational establishments, could mean that learning can become a truly lifelong activity.

*There are some significances of IT in education:*

- Access to variety of learning resources (With the help of IT now it is easy to provide audio and visual education. The learning resources are being widened and widen).
- Any time learning (One can study whenever he wills irrespective of whether it is day or night and irrespective of being in Ukraine or anywhere else).
- Authentic and up to date information (The information and data which are available on the net is purely correct and up to date).
- Online library (Internets support thousands of different kinds of operational and experimental services one of which is online library. We can get plenty of data on this online library).
- Better accesses to children with disabilities (Information technology has brought drastic changes in the life of disabled children. IT provides various software and technique to educate these poor peoples).

Using information technology in the medical field can improve the efficiency and quality of care. Information technology helps to organize patient records and can provide valuable cross-referencing information when it comes to things like drug interactions. Because of the rise in the number of medical images captured and used in treatment for a variety of conditions, information technology is especially important for storing images and locating them when needed. Even reading medical images may require IT assistance because of the increasing complexity of imaging technologies.

If we talk about culture life we can't forget about museums. Digital databases of museum collections enable easy access of workers to different objects in the funds, and they also prevent museum exhibits from wearing out. Also, the digitalized information on museum collections opens up new possibilities to present these objects on the Internet and to attract interest of new target groups.

It is obvious that development of IT is very important for every country. That's why high level of knowledge in this sphere will help to become more modern.

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**OFFSETDRUCK**

Der Offsetdruck (offset engl. für "Der Abdruck" oder auch "Versatz") ist das Verfahren unserer Zeit für die Herstellung von Drucksachen. Beim Offsetdruck erfolgt der Druck das zu bedruckende Medium nicht direkt, sondern indirekt. D.h.: die Druckfarbe wird

auf die Druckplatten aufgetragen und von dort aus auf Gummiwalzen übertragen, die endlich die Farbe wiederum auf das Papier bringen.

Bereits im Jahre 1796 erfand ein gewisser Herr Alois Senefelder die Lithographie, eine Drucktechnik mit Steinplatten als Druckform. Da der Umgang mit Steinplatten natürlich weder bei der Herstellung der Druckformen, noch beim Druck selber von großem Vorteil ist, wurden schon bald Zinkplatten eingesetzt, aber aus qualitativen Gründen nicht den direkten Druck auf Papier ermöglichte. Daher übertrug man das Bild zunächst auf eine Gummiwalze, die das Bild nun wiederum auf das Papier bringen konnte. Dies nennt man dann den »indirekten Flachdruck«, das Grundprinzip des Offsetdruckes.

Der Offsetdruck ist ein indirektes Flachdruckverfahren. Das Offsetdruckverfahren hat sich im heutigen Alltag weit verbreitet und den klassischen Buchdruck sehr schnell verdrängt. Aktuell werden schätzungsweise 60% aller Drucksachen mit dem Offsetdruckverfahren produziert. Der Offsetdruck basiert im Grunde auf dem Steindruck (direkter Farbauftrag von Farbträger auf Druckobjekt und damit direktes Druckverfahren) und hat sich zu einem indirekten Druckverfahren weiterentwickelt.

Beim klassischen Offsetdruck werden die Druckplatten mit einer speziellen Substanz beschichtet, anschliessend werden die "Belichtungsfilme" (transparente Folie mit "lichtundurchlässiger" schwarzer Farbe, die das spätere Druckmotiv darstellt, aufgelegt und die Druckplatten mit UV-Licht bestrahlt, dabei werden die belichteten Teile der Substanz mit den Druckplatten fest verbunden, die unbelichteten Bestandteile (verdeckt durch die schwarzen Flächen des Belichtungsfilmes) gehen beim anschliessenden Waschvorgang der Druckplatte verloren. Somit ist das Druckmotiv auf der Druckplatte in Form von Teilen mit der speziellen Substanz.

Diese spezielle Substanz sorgt dafür, dass die Druckplatte zwei unterschiedliche Bereiche aufweist: lipophilen (lipo = "Fett", phil = "Liebe, liebend") und hydrophilen (hydro = "Wasser", phil = "Liebe, liebend"). Der lipophile Bereich "liebt" Fett und stösst Wasser ab, nimmt somit also die Druckfarbe auf, im Gegensatz zum hydrophilen Bereich, der Wasser "liebt" (anzieht) und dadurch keine Druckfarbe auf. Wenn die Druckplatte nun vollflächig mit Farbe bedeckt wird, haftet diese nur an den lipophilen Bereichen und entsprechend nur diese Areale werden dann auf die Gummiwalzen übertragen und von dort letztendlich auf das Papier.

Ein qualitativer Vorteil des Offsetdruckes ist vor allen Dingen das Fehlen jeglicher „Abdrücke“ im Papier, so wie es im Hochdruck üblich ist. Der Hochdruck überträgt ein Bild wie einen Stempel (Die Farbe sitzt auf dem erhabenen Teil, im Gegensatz zum Tiefdruck), der sich in das Papier drücken kann - so wie man es von sehr alten Büchern her kennt, die mit Bleiletern gedruckt wurden. Dieser Effekt hat natürlich viele Nachteile im Buchdruck, besonders im beidseitigen Werk. Im Offsetdruck als Flachdruck fehlt dieser Effekt, denn die verwendeten Druckformen / Druckplatten haben keine Vertiefungen wie die klassischen Druckformen im Hoch- oder Tiefdruck. Die Druckfarbe hält auf den Druckplatten nur an bestimmten Stellen - eben diese, die bei der Herstellung eine haftende Oberfläche bekommen haben.

## **THE PROBLEM OF THE DIFFRACTIONAL PEAKS OF DIRECTIONAL CHARACTERISTICS IN ARRAY RADARS**

An important trend in the creation of modern and advanced radars is the implementation of Digital Array Radar technology.

Digital Array Radar (DAR) is a multi-channel antenna-receiver system with digital creation of diagrams, that allows to implement efficient algorithms for radar processing, based on the theory of multi-channel analysis.

Despite the known benefits of DAR over the PAR (Phased Array Radar), under certain conditions, there are contradictions between the desired high directivity and a limited number of acceptable active receiver modules. This leads to the fact that the array elements are forced to lie at a distance from each other larger than  $\lambda/2$  ( $\lambda$  – the length of the received wave), and there appear the diffraction peaks in the directional characteristics (DC) of the synthesized channels.

The appearance of diffractive peaks lead to ambiguity in measuring the coordinates of signal resources.

There are several ways to solve this problem.

The most radical of them is based on such way of antenna elements location, that disturbs the periodicity of their relative position on antenna canvas, that is one of the causes of diffractive peaks.

One of the technical decisions is associated with the use of triangular (hexagonal) arrangement of the elements. The advantage of this geometry of elements arrangement in relation to DAR is that the introducing the radar array as a set of two built-in flat equidistant arrays, makes possible to get the resulting DC of the synthesized channel, that possesses a number of important properties. Firstly, such characteristic is factored. Second, the resulting array of the spatial characteristics has a general phase center. Both of these properties facilitate the implementation in DAR the algorithms of multi-channel analysis.

As another technical solution can be offered the nonequidistant symmetrical arrangement of array elements in rows and columns relative the axial sections, that lie through the phase center of the array. This geometry provides the DC of the synthesized channels all properties, told about above. The problem of optimizing the location of array elements is reduced to choosing the appropriate distance between them. It can be solved by the well-known mathematical methods. As the optimality of the geometric arrangement of the array elements may be the discrepancy in the region of first diffraction peak, values of the function, describing the DC of projected array, and support function, as that can be taken, e.g., a function describing the Dolph-Chebyshev (optimal) DC of the radar array.

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## **CLOUD COMPUTING**

You may have heard the term cloud computing or 'the Cloud,' but could you describe what it is? There are so many definitions flying around that you wouldn't be alone if you struggled to define it. Cloud computing is simply a set of pooled computing resources and services delivered over the web. When you diagram the relationships between all the elements it resembles a cloud.

Cloud computing—not to be confused with grid computing, utility computing, or autonomic computing—involves the interaction of several virtualized resources. Cloud Servers connect and share information based on the level of website traffic across the entire network. Cloud computing is often provided "as a service" over the Internet, typically in the form of infrastructure as a service (IaaS), platform as a service (PaaS), or software as a service (SaaS).

Traditional business applications have always been very complicated and expensive. The amount and variety of hardware and software required to run them are daunting. You need a whole team of experts to install, configure, test, run, secure, and update them. When you multiply this effort across dozens or hundreds of apps, it's easy to see why the biggest companies with the best IT departments aren't getting the apps they need. Small and mid-sized businesses don't stand a chance.

With cloud computing, you eliminate those headaches because you're not managing hardware and software. The shared infrastructure means it works like a utility: You only pay for what you need, upgrades are automatic, and scaling up or down is easy. Cloud-based apps can be up and running in days or weeks, and they cost less. With a cloud app, you just open a browser, log in, customize the app, and start using it.

Cloud computing technology is sparking a huge change in application development circles. Just like the changes that moved publishing technology from paper to bits, making it possible for us to have information about anything in the world right at our fingertips in a flash, the move to a cloud computing infrastructure for application development is making it possible to build robust, enterprise-class applications in a fraction of the time and at a much lower cost.

## **A PRACTICAL BINARY PLANTING ATTACK IN UNIX-LIKE SYSTEMS**

Binary planting is a type of attack when the attacker places (i. e., plants) a binary file containing malicious code to some local or remote file system in order to be loaded and executed by a vulnerable application. [2] Usually malicious code is contained within a shared library.

There can be various reasons why an application would load a planted library. Insecure permissions may allow an attacker to place the malicious library in a trusted location. Fortunately, most Unix-like systems ship with proper permissions set on system directories so this attack vector doesn't exist unless system administrator messes up the permissions himself. Another possible cause of loading malicious code is the application itself searching for shared libraries in untrusted locations, possibly located on remote file systems.

The latter was the reason for a wave of recent binary planting attacks on more than 200 Windows applications including some applications produced by Microsoft itself. [3] The problem was caused by interaction of two factors: applications loading shared libraries without specifying a full path and insecure behavior of WinAPI LoadLibrary function in this case.

The research conducted in this work was directed towards finding a mechanism that allowed an application to load a shared library from untrusted location in Unix-like systems.

The exact mechanism that was found in applications modifying the LD\_LIBRARY\_PATH variable in order to include their own directories with shared libraries. Most applications simply append their own library path onto existing value of the LD\_LIBRARY\_PATH variable. If the variable was initially set to an empty string, then an empty entry is obviously included into the resulting value. The problem is that an empty entry in LD\_LIBRARY\_PATH means “current directory”, an insecure location. Thus an application can configure itself to load shared libraries from the current directory.

This vulnerability was discovered in Mozilla Firefox and fixed in versions 3.6.11 and 3.5.14. [1] The author would like to thank Mozilla developers for quick and professional response.

The vulnerability itself is idiomatic just like the one in Windows. Vulnerabilities of the same class were found in other popular applications but have not been fixed yet.

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### **GENERAL-PURPOSE COMPUTING ON THE GPU (GPGPU)**

Parallelism is the future of computing. Future microprocessor development efforts will continue to concentrate on adding cores rather than increasing single-thread performance. The highly parallel graphics processing unit (GPU) is rapidly gaining maturity as a powerful engine for computationally demanding applications. The GPU’s performance and potential offer a great deal of promise for future computing systems. However the architecture and programming model of the GPU are slightly different from the commodity single-chip processors.

One of the historical difficulties in programming GPGPU applications has been that despite their general-purpose tasks having nothing to do with graphics, the applications still had to be programmed using graphics APIs. In addition, the program had to be structured in terms of the graphics pipeline, with the programmable units only accessible as an intermediate step in that pipeline, when the programmer would almost certainly prefer to access the programmable units directly.

This programming model is powerful for several reasons. First, it allows the hardware to fully exploit the application’s data parallelism by explicitly specifying that parallelism in the program. Next, it strikes a careful balance between generality (a fully programmable routine at

each element) and restrictions to ensure good performance (the SPMD model, the restrictions on branching for efficiency, restrictions on data communication between elements and between kernels/passes, and so on). Finally, its direct access to the programmable units eliminates much of the complexity faced by previous GPGPU programmers in co-opting the graphics interface for general-purpose programming. As a result, programs are more often expressed in a familiar programming language and are simpler and easier to build and debug. The result is a programming model that allows its users to take full advantage of the GPU's powerful hardware but also permits an increasingly high-level programming model that enables productive authoring of complex applications.

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**SCADA**

SCADA acronym means “Supervisory Control And Data Acquisition” and generally refers to industrial control systems: computer systems that monitor and control industrial, infrastructure, or facility-based processes such as industrial processes including those of manufacturing, production, power generation, fabrication, and refining, which may run in continuous, batch, repetitive, or discrete modes.

A SCADA System usually consists of the following subsystems: a Human-Machine Interface is the apparatus which presents process data to a human operator; a supervisory computer system, gathering data on the process and sending commands (control) to the process; Remote Terminal Units (RTUs) connected to sensors in the process; Communication infrastructure connecting the supervisory system to the Remote Terminal Units.

The term SCADA usually refers to centralized systems which monitor and control entire sites, or complexes of systems spread out over large areas (anything between an industrial plant and a country). Most control actions are performed automatically by Remote Terminal Units or by programmable logic controllers. Host control functions are usually restricted to basic overriding or supervisory level intervention.

SCADA systems typically implement a distributed database, commonly referred to as a tag database, which contains data elements called tags or points. A point represents a single input or output value monitored or controlled by the system. Points can be either "hard" or "soft". A hard point represents an actual input or output within the system, while a soft point results from logic and math operations applied to other points.

The HMI system usually presents the information to the operating personnel graphically, in the form of a mimic diagram. This means that the operator can see a schematic representation of the plant being controlled.

An important part of most SCADA implementations is alarm handling. The system monitors whether certain alarm conditions are satisfied, to determine when an alarm event has occurred. Once an alarm event has been detected, one or more actions are taken (such as the activation of one or more alarm indicators, and perhaps the generation of email or text messages so that management or remote SCADA operators are informed). In many cases, a SCADA operator may have to acknowledge the alarm event; this may deactivate some alarm indicators, whereas other indicators remain active until the alarm conditions are cleared.

The move from proprietary technologies to more standardized and open solutions together with the increased number of connections between SCADA systems and office

networks and the Internet has made them more vulnerable to attacks. Consequently, the security of SCADA-based systems has come into question as they are increasingly seen as extremely vulnerable to cyberwarfare/cyberterrorism attacks.

Generally speaking, a SCADA system always refers to a system that coordinates, but does not control processes in real time. But considering the progress of newer telecommunications technology, enabling reliable, low latency, high speed communications over wide areas, it becomes more real to use real-time based distributed control systems in SCADA solutions. The use of SCADA-systems is becoming more profitable every day, so in the near future, the vast majority of production facilities will be supervised and controlled by them.

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### **AN ANT ALGORITHM FOR THE GRAPH COLOURING PROBLEM**

The ant algorithm is a multi-agent system based on the idea of parallel search. Many assignment and combinatorial problems may be formulated in terms of graph colouring, which means selection of an appropriate colour for each node of graph avoiding same colours in any two adjacent nodes, applying the minimum possible number of colours in a reasonable time.

This problem is NP-hard, hence approximate methods have to be used.

In this algorithm ants move around the nodes of a graph and change the colour of each visited node according to a local criterion. At given iteration each ant moves from current node to the adjacent one, with the maximum number of violations, with some probability (otherwise – randomly to any adjacent node) and replaces its previous colour with a new one to minimize the number of violations (also probabilistically). The violation is a situation when adjacent nodes have the same colour.

Each ant builds an independent solution (list of colours for nodes) and if one of the ants cannot decrease total number of violations – its colouring is replaced with the best one to prevent the convergence of an algorithm.

The probabilistic nature of this algorithm allows ants to escape from local minima and obtain bounds close to the absolute minimum. Iteration is repeated till the solution is found or there are no changes of violations total number for a long period of time (adjustable).

The number of ants is adjustable too, but it has to be increased with the growth of the graph size. An algorithm consists of several main operations:

- move from the current node to the next one in neighborhood;
- assign the new colour to the next node;
- continue the search;
- parallel operator (several ants work simultaneously).

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### **INNOVATION IN INFORMATION TECHNOLOGIES**

“Innovation is what distinguishes between a leader and a follower” This is a statement often attributed to Apple cofounder Steve Jobs. Nowhere is this saying truer than in the realm of information technology (IT), where the blistering pace of change can make even casual observers dizzy.

The Innovation & Advanced Technology Group (IAT) Task: identify, investigate, and understand new technologies much earlier in their life cycle—months to years before they hit the mainstream—so that organizations have time to get ready.

Competency and Capability. Skillful nurturance and management of innovation—itsself a sign of innovation in a large company—is a competitive advantage that will grow as IT's footprint grows and IT matures as a strategic lever in health care.

Focused Creativity. Innovations are typically built upon prior innovations. It takes an open and creative mind to look at an array of diverse old and new technologies and determine value through adoption, synergy, repurposing, or scope change.

The Ultimate Goal. Superior organizational performance is the ultimate mark of successful IT innovation.

Telehealth Communication technologies and physiologic monitoring devices are used to extend care and communicate with patients who can be appropriately managed with this modality.

Mobility and Wireless is an area of focus that recognizes the recent global explosion in the use of mobile devices. These include cell phones, smart phones, ultraportable notebooks and tablets, and handheld entertainment/ gaming systems in which features and applications like context-aware user interfaces, voice and text communications, biometric authentication, location tracking, and other capabilities are converging.

Time and cost savings are based on communication technologies.

Information technologies in medicine. Chronic care management is a top priority for most health care organizations due to the disproportionate resources consumed by patients with chronic illnesses. New forms of care which include digital pathology, genomics, robotics, virtual world technology, brain fitness, and many other technologies that are forging new fields of innovation.

Hype to Reality. Using objective analysis similar to how best practices are defined in medicine, we sift through the hype to discover the truth. IAT develops an accurate picture of benefits, costs, and risks not only in the contexts of technology, vendor, industry, market, and time horizon, but in the more specialized contexts of health care.

Creating a Culture of Innovation. Other key initiatives include the new KP-IT Innovation Fund to foster internal innovation, and KP's first user-oriented software development environment, which will support Innovation Fund projects as well as other IT projects.

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## **CRYPTOGRAPHY AS AN INFORMATIONAL TECHNOLOGY**

Cryptography is the practice and study of hiding information. It has long been of interest to intelligence gathering and law enforcement agencies. Before the modern era, cryptography was concerned solely with message confidentiality (encryption)—conversion of messages from a comprehensible form into an incomprehensible one and back again at the other end, rendering it unreadable by interceptors or eavesdroppers without secret knowledge (namely the key needed for decryption of that message).

In today's environment, cryptography is considered a branch of both mathematics and computer science, and is affiliated closely with information theory, computer security, and



engineering. Cryptography is used in technologically advanced applications, including areas such as the security of ATM cards, computer passwords, and electronic commerce, which all depend on cryptography. Encryption was used to ensure secrecy in communications, such as those of spies, military leaders, and diplomats. In recent decades, the field has expanded beyond confidentiality concerns to include techniques for message integrity checking, sender/receiver identity authentication, digital signatures, interactive proofs and secure computation, among others. The development of digital computers and electronics after WWII made possible much more complex ciphers. Computer use has thus supplanted linguistic cryptography, both for cipher design and cryptanalysis. Good modern ciphers have stayed ahead of cryptanalysis. The goal of cryptanalysis is to find some weakness or insecurity in a cryptographic scheme, thus permitting its subversion or evasion. The modern field of cryptography can be divided into several areas of study, e.g. symmetric-key algorithm, stream ciphers, block ciphers, asymmetric key algorithm.

Most ciphers, can be broken with enough computational effort by brute force attack, but the amount of effort needed may be exponentially dependent on the key size, as compared to the effort needed to use the cipher. This means it must be shown that no efficient method (as opposed to the time-consuming brute force method) can be found to break the cipher. Since no such showing can be made currently, as of today, the one-time-pad remains the only theoretically unbreakable cipher. There are a wide variety of cryptanalytic attacks, and they can be classified in any of several ways. A common distinction turns on what an attacker knows and what capabilities are available. In a ciphertext-only attack, the cryptanalyst has access only to the ciphertext (good modern cryptosystems are usually effectively immune to ciphertext-only attacks). In a known-plaintext attack, the cryptanalyst has access to a ciphertext and its corresponding plaintext. In a chosen-plaintext attack, the cryptanalyst may choose a plaintext and learn its corresponding ciphertext (perhaps many times). One or more cryptographic primitives are often used to develop a more complex algorithm, called a cryptographic system, or cryptosystem. Cryptosystems are designed to provide particular functionality while guaranteeing certain security properties. Cryptosystems use the properties of the underlying cryptographic primitives to support the system's security properties. Of course, as the distinction between primitives and cryptosystems is somewhat arbitrary, a sophisticated cryptosystem can be derived from a combination of several more primitive cryptosystems.

So, cryptography is very difficult cipher technology.

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### **BOEING F-22 RAPTOR**

The first operational F-22 Raptor is painted at the Lockheed Martin assembly plant at Marietta, Georgia

The YF-22 was modified for the production F-22. Several small design changes were made. The swept-back angle on the wing's leading edge was decreased from 48 degrees to 42 degrees, while the vertical stabilizer area was decreased 20%. To improve pilot visibility, the canopy was moved forward 7 inches (178 mm) and the engine intakes were moved rearward 14 inches (356 mm). The shape of the wing and stabilator trailing edges was refined to improve aerodynamics, strength, and stealth characteristics. Also, the vertical stabilizer was shifted rearward.

Its dual afterburning Pratt & Whitney F119-PW-100 turbofans incorporate pitch axis thrust vectoring, with a range of  $\pm 20$  degrees. The maximum thrust is classified, though most sources place it at about 35,000 lbf (156 kN) per engine.[97] Maximum speed, without external weapons, is estimated to be Mach 1.82 in supercruise mode;

The FB-22 was a proposed medium-range bomber for the USAF.[169] The FB-22 was projected to carry up to 30 Small Diameter Bombs to about twice the range of the F-22A, while maintaining the F-22's stealth and supersonic speed.[170] However, the FB-22 in its planned form appears to have been canceled with the 2006 Quadrennial Defense Review and subsequent developments, in lieu of a larger subsonic bomber with a much greater range

#### **General characteristics**

- **Crew:** 1
- **Length:** 62 ft 1 in (18.90 m)
- **Wingspan:** 44 ft 6 in (13.56 m)
- **Height:** 16 ft 8 in (5.08 m)
- **Wing area:** 840 ft<sup>2</sup> (78.04 m<sup>2</sup>)
- **Airfoil:** NACA 64A?05.92 root, NACA 64A?04.29 tip
- **Empty weight:** 43,430 lb (19,700 kg)
- **Loaded weight:** 64,460 lb (29,300 kg)
- **Max takeoff weight:** 83,500 lb (38,000 kg)
- **Powerplant:** 2× Pratt & Whitney F119-PW-100 Pitch Thrust vectoring turbofans
- **Dry thrust:** 23,500 lb(104 kN) each
- **Thrust with afterburner:** 35,000+ lb (156+ kN) each
- **Fuel capacity:** 18,000 lb (8,200 kg) internally, or 26,000 lb (11,900 kg) with two external fuel tanks

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### **MODERN METHODS AND ALGORITHMS PROTECTION INFORMATION IN COMPUTER INFORMATION TECHNOLOGIES**

Developing of new information technologies, lead us that the protection of information is not only obliged but becomes one of the characteristics of information system (IS). There is a big class of systems, of handling information, where security of information is one of the most principle activities (for example information systems of open outcry, or bank information systems).

Security of information system means the immunity from accidental or deliberate intervention into the normal process of functioning, from attempts of stealing (unauthorized receiving) the information, modification or destroying parts of it.

The main threats, of security information(SIS) and normal functioning of information systems, are: leak of confidential information, compromise of information, unauthorized using of information recourses, mistaken using of information recourses, unauthorized changed with the information between subscribers, violation of information services, illegal usage of privileges, stealing the carrier of information etc.

The main threats, of security information afford harmful programs which were invented for this aims. Large amount of this programs don't permit to make invariable and solid assets against them. The harmful programs can be classified into: logical bombs, Trojan horses, worms, invader of passwords and others.

Creating of SIS in IS and IT is found on the following principles: system approach, the principle of uninterrupted development of system, guarantying the safety of the system security.

As a result to solve the problem of SIS in modern IS are used such methods: stonewalling, administration of access, different methods of encryption, opposition attack of harmful programs, utility assets, physical assets and program assets.

One of the best assets of save information in our days is encrypting of data or cryptography. The information letter or data that is ready for sending , is unsafe, is encrypting – this means they are converted into cipher text .In this view of the document to get the access to data without knowing the special algorithm of encrypting is practically impossible, especially today because there are several hundreds of algorithm of encryption. The most popular are RSA, TEA, XXTEA, IDEA and Rijndael.

There are several cryptic systems with an open key. The system that is the most developed is RSA. RSA is a system of collective usage, every user of each has his own keys to encrypt and decrypt of data but the secret key is only the decryption key.

Therefore there are several requirements that the such system should have. They are:

- The procedure of encryption and decryption should be 'transparent'.

- Decryption of sycret information should be complicated to person which are not allowed to do this.

- The data that is in should not have effect on working of decryption algorytm.

It is really pity that encrypting now days is used in short amount of systems mainly they are: military systems or systems of macro companies. But nowadays there is a tendency that more and more information systems have great security. If the tendency will continue soon we will have great secured information systems.

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## **SOFTWARE AS A SERVICE**

The concept of "software as a service" started to circulate prior to 1999 and was considered to be "gaining acceptance in the marketplace" in Bennett et al., 1999 paper on "Service Based Software" .

SaaS as a concept is often associated with the application service providers (ASPs) of the 1990s, which provided "shrink-wrap" applications to business users over the Internet. These early attempts at Internet-delivered software had more in common with traditional on-premise applications than with modern SaaS applications in some ways, such as licensing and architecture. Because these applications were originally built as single-tenant applications, their ability to share data and processes with other applications was limited, and they tended to offer few economic benefits over their locally installed counterparts.

Today, SaaS applications are expected to take advantage of the benefits of centralization through a single-instance, multi-tenant architecture, and to provide a feature-rich

experience competitive with comparable on-premise applications. A typical SaaS application is offered either directly by the vendor or by an intermediary party called an aggregator, which bundles SaaS offerings from different vendors and offers them as part of a unified application platform.

SaaS consists of three main models, such as:

#### Application Architecture

It means that rather than purchase the hardware / software to run an application, customers only require a computer or a server to download the application and internet access and utilise the software.

#### Business Model

It means that SaaS can also lower the initial adoption cost for the customer, making the SaaS model more attractive in times of limited budgets.

#### Operational Structure

It means that SaaS takes to deliver the application to customers, and to keep it available and running well at a cost-effective level.

Software as a Service (SaaS) – meaning delivering software over the Internet – is increasingly popular for its ability to simplify deployment and reduce customer acquisition costs; it also allows developers to support many customers with a single version of a product.

For example, Company NetSuite is the first and only company to give growing and midsize businesses on demand Web-based business applications to run their entire company. With thousands of customers globally, NetSuite has earned numerous awards for market leadership and innovation

SaaS is "simple" application architecture can then be applied to a wide range of software applications for use by either business enterprises or individual end-users.

So finally, where does the future of SaaS leave Usability and User Experience? Well in a very exciting position I think. Increasingly we will be released from the artificial barriers HTML imposes upon us and be able to have incredibly flexibility in the way we approach and solve problems. Information Architects will continue to play an important role in organising and structuring content, but Interaction Designers will truly be let off the leash!

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## **FACTORS INFLUENCING QUALITY OF TELEVISION IMAGE IN THE SYSTEM OF THE DIGITAL TELEVISION BROADCASTING**

Introduction of the digital television broadcasting was advertised to viewers as possibility of receiving the best quality conditioned by use of the modern digital technology of the signal processing. The key deterrent factor is absence of standard for digital broadcasting and, accordingly, impossibility to grant licenses. One of the main problems connected with estimation of quality of the digital television broadcasting consists of new principles of digital processing and transmission of dynamic images. As criteria is not yet developed, it appears interesting to estimate factors determining quality of image.

With the purpose of the estimation of factors influencing descriptions of digital television signal at the stage of transmission we will consider its basic structural blocks. Prepared TV programs get to the entrance of videocoder, where a compression of information

and the forming of digital transport flows take place. The compressed signals get to the mux input to form total transport flow. A transport flow of MPEG2 from the output of mux gets to a modulator where anti-jamming encoding is carried out on the basis of Reed-Solomon's and Viterbi's codes. Then output frequency of modulator is given on a high-frequency transmitter device. The used equipment directly influences quality of transmission.

We will consider processes happening to the television signal on the stage of its compression to determine possibility of error. It is generally known that all methods of compression of images providing the high coefficients of compression suppose some losses. These losses are connected with refusal to transmit or some "roughing" of components of image, to exactness of reproducing of which a human eye has small sensitivity.

The hybrid method of encoding is used in the standard of MPEG, as it combines inframe and interframe compression. A compression results in appearance of defects of quality are not found previously. Errors can occur in the process of complex processing while multiplexing programs in a single dataflow. Timing and time matching errors can disturb the process of decoding. The roughest type of distortions is a blocking-effect which is conditioned by breaking of all the image into blocks  $8 \times 8$  pixels before carrying out discrete-cosine transformation (DCT).

The algorithm of DKP, using correlating effects, makes transformation of blocks to frequency Furie-components. Thus small part of information is lost from rounding off due to smoothing of the strongly selected areas which do not correlate. After this procedure the algorithm of quantum, using the matrix of quantum, the elements of which are rationing coefficients for frequency Furie-components, comes into an action. After a quantum many coefficients are zeroed in a block. The more shallow details were contained in an initial block the higher is the number of non-zero spectral constituents.

We have considered basic technical factors influencing quality of signal at the stage of DCT, transitions between levels can also substantially change initial digital signal. The considered factors are technical descriptions of the separate stages of transmission, but the end user is a viewer, therefore the estimation of quality can be confirmed by an expert estimation, because perception of man is associative.

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### **BICLUSTERING IN DATA ANALYSIS**

Clustering only the records in a database (or data matrix) gives a global view of the data. For a detailed analysis or a local view, biclustering is required, involving the clustering of the records and the attributes simultaneously.

Biclustering (also known as co-clustering or two-mode clustering) is a data mining technique which allows simultaneous clustering of the rows and columns of a matrix. The term was first introduced by Mirkin, although the technique was originally introduced much earlier (by J.A. Hartigan). Generally, it finds clusters of samples possessing similar characteristics together with features creating these similarities. For example, given a set of  $m$  rows in  $n$  columns (an  $m \times n$  matrix) the biclustering algorithm generates biclusters – a subset of rows which exhibit similar behavior across a subset of columns [1, 3].

This group of methods was firstly proposed for the analysis of gene expression data obtained from microarray experiments. The problem was that results from the application of standard clustering methods to genes were limited. This limitation was imposed by the

existence of a number of experimental conditions where the activity of genes is uncorrelated. A similar limitation exists when clustering of conditions is performed. For this reason, a number of algorithms that perform simultaneous clustering on the row and column dimensions of the data matrix had been proposed. The goal is to find subgroups of genes and subgroups of conditions, where the genes exhibit highly correlated activities for every condition [2].

In general, the biclustering concept allows to identify groups that cannot be found by a classical clustering approach that always operates on all experimental conditions. The complexity of the biclustering problem depends on the exact problem formulation and on the merit function used to evaluate the quality of a given bicluster. However most interesting variants of this problem are NP-complete requiring either large computational effort or the use of lossy heuristics to short-circuit the calculation. Nowadays biclustering algorithms (such as FABIA, cMonkey, X-Sim, CTWC, FLOC, RoBA) are using in bioinformatics, document's clustering, recommender systems, dimensionality reduction and in information retrieval (particularly in targeted marketing and text mining). It is irreplaceable when you are solving a problem which provides a conservation of feature descriptions of clusters [2].

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### **ENVIRONMENTAL MONITORING SYSTEM USING ADVANCED INFORMATION TECHNOLOGIES**

The problems associated with environment conditions, air and water pollution, epidemiologic situation and radiological hazard levels are among the most pressing ones. Unfortunately, there are no systems that allow to gain access to relevant information about the state of the environment, living conditions in certain regions, ecological norms and standards.

There are following solutions to the outlined problems:

1. Create a unified resource in the Internet for receiving the essential information about the state of the environment, various conditions and standards all around the world.
2. Transform data of the environment state to a unified standard within the system.
3. Establish connections with various governmental and public organizations to cooperate (receive and verify the information) within the system.

The project represents a global geoinformation system, implemented as a Web-application using the concepts of Web 2.0. The system contains interfaces for both end-users and experts.

Users are granted public access to an interactive map, working with which they can obtain information about their region of interest. Also they have following abilities: evaluating the environmental risk, getting security measures, attracting public attention. In addition, they have the opportunity to highlight a region and send a request, to catch the attention of experts to problems that exist in that region. Users can also alter the rating of existing problems, as well as engage in online discussions and conferences.

The project allows: to collect data about the environment, sufficient for extensive analysis and ensure its completeness; to formalize the collected data, i.e. make it available for end-users; to ensure the reliability and relevance of the information by enlisting the help of experts from various organizations for control.

The project architecture consists of following components: BingMaps Silverlight control, MS SQL Server database, mobile devices support servers, BingMaps XML-service, Additional XML-services.

A large number of modern developers' tools and technologies are used in the project, such as: Microsoft Visual Studio 2010, BingMaps technology, Silverlight 4.0, Application development for Windows Mobile, Use of XML web-services, MS SQL Server 2005, .NET 4.0, Expression Studio ASP.NET

The project was presented at an international competition Imagine Cup 2010. It has drawn the attention of investors. Now negotiations are underway to implement the project in one of the largest Ukrainian mapping services.

The project implementation will give following abilities: to collect information about the environment, sufficient for extensive analysis and ensure its completeness; to formalize the collected information, i.e. make it available for end-users; to ensure the reliability and relevance of the information by enlisting the help of experts from various organizations for control.

As a result, this will provide an opportunity to consolidate the society, the government and various social organizations to resolve issues related to the environment.

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## **THE USE OF ACTUATORS WITH EXOSKELETONS**

Exoskeleton is a device designed for amplification of human muscular efforts due to external shell.

Exoskeleton repeats biomechanics of human to increase efforts when the human is moving. The Main Line of exoskeletons development is Military (aim to a combination of tank's firepower with the mobility and size of human). Such exoskeleton could turn a simple soldier into killing machine like "The Terminator".

Concept of exoskeleton's operation is based on sensing of nerve impulses, which human's brain transmits to extremities. The central computer of exoskeleton catches these signals and converts them into instructions for actuators installed in the joints of robotic arms and legs. Due to the actuators suit can respond to nerve impulses faster than human limbs.

A hydraulic actuator is a mechanical device that uses hydraulics to convert energy into a linear movement. The mechanical energy produced is generally used to lift or press things

that require a great deal of energy. Heavy equipment usually relies on several hydraulic actuators to function.

The basic mechanism for a hydraulic actuator is the conversion of the power of hydraulics. Pressurized hydraulic oil is a fluid that cannot be further compressed. When one end of the hydraulic actuator receives pressure, the hydraulic fluid multiplies that pressure and converts it to a mechanical movement. This is why hydraulic actuators are able to generate great power. One main advantage of the hydraulic actuator is the high amount of force it generates. Construction and engineering professions frequently employ hydraulic machines to serve various purposes. While lifting is commonly its main purpose, a hydraulic actuator can also push, crush, and stomp.

Accuracy and agility are two additional advantages of hydraulic machines. The piston is mostly controlled by altering the amount of hydraulic fluids inside it. There are machines that take advantage of this by mimicking the way an arm works. Several hydraulic actuators act as muscles that push and pull the exoskeleton arm to give it flexibility of movement. The line controls the amount of fluid inside the cylinder. By increasing and decreasing the fluid, the operator can control the piston movement. The piston is then attached to an external component.

HULC is the Abbreviation from Human Universal Load Carrier. This device represents a hydraulically operated titanium exoskeleton, which allows a soldier to carry weight of 90 kg (200 lbs) for an extended period of time. Weight of the exoskeleton is 20 kg(45 lbs). HULC is equipped a micro, which allows parts of exoskeleton and soldier's body to synchronous movement. Lockheed company (a developer of superstructure for human body) has a contract with U.S. Army.

HULC consist of two parts: upper and lower. Developers from Lockheed claim that the flexibility of the system allows soldiers to run, walk, kneel, crawl, and even go into low squats.

HULC is very similar to HAL - Hybrid Assistive Limb, produced by Cyberdyne (Japan). This exoskeleton designed for the elderly and people with musculoskeletal problems. However HULC much smaller and inconspicuously than the Japanese prototype.

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## **ANALYSIS AND SYNTHESIS OF INFORMATION TRANSMISSION NETWORKS**

Nowadays wide development of satellite communication systems in combination with ground-based communication systems can organize information networks with great technical capabilities. Special attention should be given for research in integrated services networks focused on the transfer of digital information known as integrated services digital networks.

Managing of the exchange of information is closely associated with the use of a combination of methods. At present two methods of land spread combinations are a combination of channels and messages, or a combination of tacts. In its turn, a combination method is used of two varieties of cycles: a combination of datagrams and a combination of virtual channels.

One of the requirements for networks is to ensure efficient use of means of communication. They are communication channels, message switching centers, etc. And



consequently, the question of methods raises and algorithms for determining of optimal data network structure that could transmit data with the necessary characteristics and speed.

Decision task is possible while ensuring high reliability of the network. A necessary condition is the introduction of reliability in network management subsystem control and diagnostics. In most works devoted to this problem, the design of control subsystems and diagnostics is considered separately and without regard to the tasks facing the network.

However, the development of subsystems control and diagnosis network is a part of the problem of network management. And much of the information on network operating system is used as network management and system maintenance. This allows you to create a single database on the status of the network. There are specific protocols that allow you to analyze and diagnose networks, but they only analyze the network for the analysis of the other data protocols and do not include the structure and algorithms of data on the physical and data link layers of the OSI model.

Works to create a subsystem control and diagnosis are closely connected with the design of most networks, since the synthesis of control devices is based on the research into network models, their purpose and structure.

Analysis of features of information transmission networks, the study of users requirements, research trends of new information services led to the conclusion that the communications infrastructure as a part of society can be the most effective only if the integration of all networks is in one global network that incorporates not only the channels, methods and algorithms for data transmission, but also a subsystem that allows to analyze existing technical conditions and characteristics of the network.

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### **INFORMATION SYSTEM SECURITY**

The information itself is the most valuable resource of every company, thus providing safety becomes major and high-priority problem. The information system security (ISS) generally relies upon two foundations: integrity and confidentiality. In other words ISS requires the information to be protected from illegal access and erasure.

There are three main types of ISS threats:

- anthropogenic threats caused by accidental or intentional subjects actions
- elemental threats caused by natural calamities
- developing threats caused by hardware or software faults leading to failures of technical or programming environment

Security facilities called to guard the anthropogenic threats:

1. Means of protecting information from unauthorized access. Access to protect information must be restricted to people who are authorized to access the information.. The foundation on which access control mechanisms are built start with identification and authentication.

2. Information security in computer networks. Consists of the provisions and policies adopted by the network administrator to prevent and monitor unauthorized access, misuse, modification, or denial of the computer network and network-accessible resources. Information security explicitly focuses on protecting data resources from malware attack or simple mistakes by people within an organization by use of data loss prevention (DLP)

techniques.

3. Cryptographic protection of information. Information security uses cryptography to transform usable information into a form that renders it unusable by anyone other than an authorized user, this process is called encryption. Cryptography provides information security with other useful applications including improved authentication methods, message digests, digital signatures, non-repudiation, and encrypted network communications.

4. Digital signature. Means mathematical scheme for demonstrating the authenticity of a digital message or document. Digital signatures are commonly used for software distribution, financial transactions, and in other cases where it is important to detect forgery and tampering. Digital signatures are also used to implement electronic signatures, a broader term that refers to any electronic data that carries the intent of a signature.

5. Virus protection. Antivirus or anti-virus software is used to prevent, detect, and remove computer viruses, worms, and trojan horses. It may also prevent and remove adware, spyware, and other forms of malware.

In order to provide the maximum ISS a complex method is used. Complex method implies integration of two or more facilities. It is important to admit that no Information System can be completely secure. It is always a matter of either security or efficiency.

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### **SPEECH ANALYTICS**

Speech Analytics(SA) is a term used to describe automatic methods of analyzing speech to extract useful information about the speech content or the speakers. Although it often includes elements of automatic speech recognition, where the identities of spoken words or phrases are determined, it may also include analysis of one or more of the following:

- the topic(s) being discussed
- the identities of the speaker(s)
- the genders of the speakers
- the emotional character of the speech
- the amount and locations of speech versus non-speech (e.g. background noise or silence)

The term "Speech Analytics" was coined by UTOPY in 2002, when UTOPY released the first commercially available Speech Analytics product. Prior to 2002, speech recognition and analysis technology had primarily been used by government agencies for intelligence gathering purposes.

SA is often used to analyze recorded calls from contact centers. The business objective of SA is often one (or a combination) of the following: to analyze the performance of customer service representatives within a contact center; to analyze the customer experience when customers call (or are called by) a company; or to glean customer intelligence or other insights by "listening" to the voice of the customer. One use of SA applications is to spot spoken keywords or phrases, either as real-time alerts on live audio or as a post-processing step on recorded speech. This technique is also known as audio mining. Other uses include categorization of speech, for example in the contact center environment, to identify calls from

unsatisfied customers. SA technology may combine results from different techniques to achieve its aims.

There are four main technology approaches "under the hood", phonetic approach, keyword spotting, grammar based and Large-Vocabulary Continuous Speech Recognition (LVCSR, better known as full transcription). Some SA vendors use the "Engine" of a 3rd party and there are some SA vendors that have developed their own proprietary engine. Also, most SA products use Speech-to-Text or Speech-to-Phoneme (also known as Phonetic) conversion methods. In these approaches, a speech recognition engine transcribes the audio into collections of words or phonemes (the smallest discreet unit of human speech), and then a text mining or search engine attempts to spot keywords-or combinations of keywords - in the converted text or phonemes.

SA is designed with the business user in mind. Usually it can provide automated trend analysis to show what's happening in your contact center. The solution can isolate the words and phrases used most frequently within a given time period, as well as indicate whether usage is trending up or down. This information makes it easy for supervisors, analysts, and others in your organization to spot changes in consumer behavior and take action to reduce call volumes - and increase customer satisfaction.

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### **SUPERSONIC COMBUSTION RAMJET**

Scramjet (means "supersonic combustion ramjet") is jet type engine, rely on combusting fuel and oxidizing it to produce thrust. Similar to classic non-rocket engines, scramjet-powered craft carry fuel onboard and use atmospheric oxygen like oxidizer. Scramjets designed to fly at hypersonic speeds, to fill the gap between low-altitude turbojets and high-speed all-sufficient rocket engines.

The scramjet is composed of three basic components: a converging inlet, where incoming air is compressed and decelerated; a combustor, where gaseous fuel is burned with atmospheric oxygen to produce heat; and a diverging nozzle, where the heated air is accelerated to produce thrust. Unlike a typical jet engine, such as a turbojet or turbofan engine, a scramjet does not use rotating, fan-like components to compress the air; rather, the achievable speed of the aircraft moving through the atmosphere causes the air to compress within the nozzle. As such, no moving parts are needed in a scramjet, which greatly simplifies both the design and operation of the engine. In comparison, typical turbojet engines require inlet fans, multiple stages of rotating compressor fans, and multiple rotating turbine stages, all of which add weight, complexity, and a greater number of failure points to the engine. It is this simplicity that allows scramjets to operate at such high velocities, as the conditions encountered in hypersonic flight severely hamper the operation of conventional turbomachinery.

A scramjet is "scion" of a ramjet. In a typical ramjet, the supersonic inflow of the engine is decelerated at the inlet to subsonic speeds and then reaccelerated through a nozzle to supersonic speeds to produce thrust. This deceleration, which is produced by a normal shock, creates a total pressure loss which limits the upper operating point of a ramjet engine.

For a scramjet, the kinetic energy of the freestream air entering the scramjet engine is large comparable to the energy released by the reaction of the oxygen content of the air with a fuel. Thus the heat released from combustion at Mach 25 is around 10% of the total enthalpy of the

working fluid. Depending on the fuel, the kinetic energy of the air and the potential combustion heat release will be equal at around Mach 8. Thus the design of a scramjet engine is as much about minimizing drag as maximizing thrust.

So, in synopsis, advantages of scramjets:

- no need to carry an oxidizer;
- no rotating parts, that means easy production.

Now, about disadvantages. So, scramjets:

- require hi-tech materials to build, as result of high pressure and temperature;
- require high speed to reach the steady combustion level;
- need low-altitude co-engine or carrier to reach the efficient altitude and speed;
- require precision flight-control system.

Looking in future, organizations around the world are researching scramjet technology. Scramjet technology have really tangible potential to rise, in military, transport and space branches.

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### **3GPP LONG TERM EVOLUTION**

3GPP Long Term Evolution (LTE) is the latest standard in the mobile network technology. It is the last step toward the 4th generation (4G) of radio technologies designed to increase the capacity and speed of mobile telephone networks. Where the current generation of mobile telecommunication networks are collectively known as 3G, LTE is marketed as 4G.

LTE infrastructure is designed to be simple to deploy and operate, through flexible technology that can be deployed in a wide variety of frequency bands. LTE supports scalable carrier bandwidths, from 1.4 MHz to 20 MHz and supports both frequency division duplexing (FDD) and time division duplexing (TDD). The LTE specification provides downlink peak rates of at least 100 Mbit/s, an uplink of at least 50 Mbit/s and RAN round-trip times of less than 10 ms. Part of the LTE standard is the System Architecture Evolution, a flat IP-based network architecture designed to replace the GPRS.

The main advantages with LTE are high throughput, low latency, plug and play, FDD and TDD in the same platform, an improved end-user experience and a simple architecture resulting in low operating costs. As a result, service providers should be able to get more data transfer out of their existing cells and possibly lower the cost to run their networks. Since LTE connects to existing networks, providers can plan for a seamless transition, then continue to use legacy CDMA and GSM networks as backups.

LTE uses such a modulation technique, as OFDM (Orthogonal Frequency Division Multiplex), and antenna technology, MIMO (Multiple Input Multiple Output).

OFDM technology has been incorporated into LTE because it enables high data bandwidths to be transmitted efficiently while still providing a high degree of resilience to reflections and interference.

One of the main problems that previous telecommunications systems have encountered is that of multiple signals arising from the many reflections that are encountered. By using MIMO, these additional signal paths can be used to advantage and are able to be used to increase the throughput.

The main advantages with LTE are high throughput, low latency, plug and play, FDD and TDD in the same platform, an improved end-user experience and a simple architecture resulting in low operating costs. LTE will also support seamless passing to cell towers with older network technology such as GSM, cdmaOne, UMTS, and CDMA2000. The next step for LTE evolution is LTE Advanced and is currently being standardized in 3GPP Release 10.

Through the LTE core network, mobile operators will be able to connect different access technologies to a single core network, allowing users, wherever they are, using any device, to access common operator provided applications and content through any access technology.

LTE gives service providers the opportunity to diversify the breadth of their services, offering much more to their subscribers within a single network. A move to LTE creates an opportunity to lower the cost of providing mobile broadband connectivity and subsequently the cost to the end-user while at the same time delivering new and improved services and applications.

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## **CRYPTOGRAPHIC METHODS OF INFORMATION PROTECTION**

Information is a global data resource of modern society. The problem of information security is of vital importance today.

The basic methods of information protection are:

hardware - electronic, electro-mechanical, electro-optical devices;

software - programs that serve as protection;

crypto - transformation of the information which prevents the contents of private data from being determined;

physical protection measures - prevent access of potential offenders to the places where important information is found.

Cryptographic methods are of major interest. Modern cryptography includes four major sections: symmetric cryptosystem, a cryptosystem with public key systems, digital signature, key management.

Symmetric cryptosystems are based on such encryption methods where encryption and decryption use the same key. The symmetric key algorithms are: AES (Advanced Encryption Standard), GOST 28147-89, DES (Data Encryption Standard), 3DES (Triple-DES, Triple DES), Blowfish, RC4, IDEA (International Data Encryption Algorithm), CAST (for Developer initials Carlisle Adams and Stafford Tavares).

Public key cryptosystems are based on encryption methods to encrypt data by using one key (open) and another one for decryption (hidden). These keys are different and can not be derived from each other. Public key algorithms are RSA (Rivest-Shamir-Adleman), DSA (Digital Signature Algorithm), Elgamal (shyfosystema El Gamal), ECC (Elliptic Curve Cryptography, elliptic curve cryptography), GOST R 34.10-2001.

Keys management. The main issue of cryptography is public keys management and safekeeping of private keys. Public keys are managed by means of a system of certificates. The most secure way to store a private key is a smart card.

Application of cryptographic methods of information security provides the solution of the basic problems related to data protection.

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### **ESOTERIC PROGRAMMING LANGUAGES**

It's a type of programming languages, that doesn't used in industrial programming. Main feature of these languages that is program text is understood only for devoted people group. Despite the fact that they created for fun, they give brain training and represents hack value. Capabilities of many purposely reduced, while another has Turing-completeness. Turing-completeness gives ability to realize any algorithm, difficulty which limited by computer capacity only. Esoteric programming languages often are allowed for using on programming contests.

The earliest, and still the canonical example of an esoteric language was INTERCAL, designed in 1972 by Don Woods and James M. Lyon, with the stated intention of being unlike any other programming language the authors were familiar with. It parodies elements of established programming languages of the day, such as Fortran, COBOL, and assembly language. Early implementations of INTERCAL were tied to the IBM System/360 and an unidentified Atari computer (probably the Atari 2600) and have not survived. For many years INTERCAL was represented only by paper copies of the INTERCAL manual. The language's revival in 1990 as an implementation in C under Unix stimulated a wave of interest in the intentional design of esoteric computer languages.

In 1992, Wouter van Oortmerssen created FALSE, a small stack-oriented programming language, with syntax designed to make the code inherently obfuscated, confusing, and unreadable. It is also noteworthy for having a compiler of only 1024 bytes. This inspired Urban Müller to create an even smaller language, the now-famous brainfuck, which consists of only eight recognized characters. Along with Chris Pressey's Befunge (like FALSE, but with a two-dimensional instruction pointer), brainfuck is now one of the most well-supported esoteric programming languages. These are canonical examples of minimal Turing tarpits and needlessly obfuscated language features; brainfuck's minimality borders on elegant and pure language design; in fact it is related to the P'' family of Turing machines.

Esoteric programming languages can be divided into nine groups. First - INTERCAL-like. Main idea of this group languages is maximum different from existing languages. Next - brainfuck-like. They have very simplified syntax (brainfuck has eight commands), but have Turing-completeness. Fungus languages use multidimensional view of program. Also, group of languages to test mathematic concepts exists. Separate group languages based on coping their own text. Next - languages like "black box". Their purpose is to difficult code writting. Also, languages with non-human logic exist. For example - Var'aq, based on logic of Klingons from the "Star Trek". To counterbalance the previous two groups, programming languages with literature syntax exists. In the end we have a big group of languages, that don't belong to any group.

There is a big community in internet. Turing completeness is a favorite topic of discussion, since it is not immediately obvious whether or not a language is Turing complete, and it often takes rather large intuitive leaps to come to a solution.

So, esoteric programming languages aren't just fun, but very good mind training.

## **USING NEURAL NETWORKS IN INTRUSION DETECTION SYSTEM**

Important step in ensuring the security of computer systems is the design of Intrusion Detection Systems (IDS). A number of different technologies which are used for protection computer networks that are based on the technology of data extraction (data mining), the neural networks, and statistical analysis are currently under development.

First of all, the shortcomings of existing models of IDS are the vulnerability which can be attributed to new attacks, low accuracy and speed. Modern intrusion detection systems are ill-suited to work in real time while the ability to handle large amounts of data in real time is the determining factor of practical use of IDS.

The main objective of the project is the development and the investigation of the neural network system for detecting attacks on computer networks. Another objective is the development of appropriate software which will be presented as a stand-alone intrusion detection system based on neural network installed on a separate server (all reports of suspicious events will be sent to a safety specialist or an automatic response system). Conclusions about the advantages and the disadvantages of IDS will be made on the model analysis.

Modern means of detecting attacks based on expert systems use rules that identify known attacks. Different approaches to the problem of intrusion detection based on a system different from the expert have been developed in recent years. But unlike expert systems which can give user a definite answer on the compliance of the analyzed and stored in a database of characteristics the neural network analyzes information and provides an opportunity to assess the harmonization of data characteristics which it is trained to recognize. The reliability of estimates depends entirely on the effectiveness of learning stage that is why particular attention is paid to the effectiveness of training the neural network.

The ability of soft computing techniques for dealing with uncertain and partially true data makes them attractive to be applied in intrusion detection. Some studies have used soft computing techniques other than Artificial Neural Networks (ANNs) in intrusion detection. For example, genetic algorithms have been used along with decision trees to automatically generate rules for classifying network connections. However, ANNs are the most commonly used soft computing technique in IDSs.

Scientific value in the project is provided by flexibility and adaptability of the algorithms, the ability to analyze data from the network, even if these data are incomplete and / or distorted, high-speed data processing, providing system performance in real time, as well as the ability to "study" the characteristics of attacks and allocation of elements that differ from those observed previously.

Many methods have been employed for intrusion detection. However, modeling networking traffic for a simple representation to a neural network shows great promise, especially on an individual attack basis. Once trained, the neural network can make decisions quickly, facilitating real-time detection. Neural Networks using both supervised and unsupervised learning have many advantages in analyzing network traffic and will be a continuing area of the scientific research.

## **A QUANTUM COMPUTER**

Information symbols can be associated with discrete states of quantum systems obeying the Schrodinger equation and the quantum evolution controlled from outside relates to the information (computing) process. Such reflection makes a quantum system (a particle) in a quantum device. A set of quantum devices used to build quantum information systems can be called a quantum element base.

The possibility of quantum computers and communication systems design is confirmed by modern theoretical and experimental researches. A new technique of the XXI century is generated by the synthesis of new ideas in mathematics, physics, computer science and technology. The interaction of the fundamental branches of science and technology generate a new technique.

It is important to emphasize that in the process of quantum informatics tasks solving there are the development and understanding of the quantum physics foundations. Its main problems such as locality (causality), the hidden parameters, the reality, uncertainty, additional measurements, and the wave function collapse are subject to a new analysis and experimental check.

For the quantum computation realization it is important to solve several significant practical tasks. First of all, it is necessary to isolate a quantum system from the environment for some period of time for performing the calculation. Even small interaction with the environment can damage the qubits (the problem of decoherence). Currently, this is one of the major obstacles in building quantum computers. Concatenated qubit states are extremely sensitive to such processes, as one single impact on any of them can destroy the entire state. Despite the fact that a quantum system must be isolated from the environment, there should be the possibility to interact with the system for transforming it in the desired quantum state. In addition, it is necessary to develop mechanisms for the quantum logic operations implementation as well as methods to determine a quantum system state at the end of the calculations. All these problems can be solved within the ongoing worldwide experiments.

One of the research areas is the application for the quantum registers ion traps organization operated by laser flash. Each ion represents a qubit. Ground and excited states of the ion correspond to the values 0 and 1. Another possibility is to use a silicon crystal with pointwise interstitial atoms whose spins are the quantum computer qubits. In such a crystal there is no an electric current: interacting with each other, the atoms will pass the message from one to another according to the laws of quantum logic.

The nuclear magnetic resonance (NMR) application is the most promising in a liquid contained a large number of similar molecules. Qubits are encoded with a nucleus spin of every atom of the molecule. Due to the natural isolation from the environment, nuclear spins are particularly good qubits. At present there are the quantum algorithms experimental implementation using NMR. In particular, the simplest version of Deitch- Jose's quantum algorithm has been carried out, which determines whether an unknown function is balanced.

To implement the "full length" programs, approximately 1000 qubits will be needed, which now seems a distant dream. Some scientists believe that decoherence can not be reduced to an acceptably low value and, hence, only a few computational steps can be executed.



## **QT LANGUAGE**

Programming language is an artificial language designed to express computations that can be performed by a machine, particularly a computer. There is a very huge variety of this languages developed for different operating systems and technics. One of them is Qt language. Qt is a cross-platform application framework that is widely used for developing application software with graphical user interface (GUI), and is also used for developing non-GUI programs such as command-line tools and consoles for servers.

Qt uses standard C++, but makes extensive use of a special code generator (called the Meta Object Compiler, or moc) together with several macros to enrich the language. Using Qt, you can write web-enabled applications once and deploy them across desktop, mobile and embedded operating systems without rewriting the source code. Thanks to cross-platform characteristic application and software developed on Qt works [great] on Windows, Embedded Linux, Linux/X11 (Including Solaris, AIX, HP-UX), Mac OS X., Windows Mobile/Ce platforms, Symbian, MeeGo and a few more. In spite of cross-platforming this programming language has sometimes better runtime performance than C or C++ languages, especially if we take into consideration that they are similar in some moments. Except this, Qt is a “young” language, so it has a modern development kits and new, regular updated, documentation. For example it is available as a stand-alone package or in combination with the Qt libraries and development tools as a complete SDK (Software Development Kit). Special place in Qt SDK takes Qt Creator - it is a cross-platform integrated development environment (IDE) tailored to the needs of Qt developers. Qt Creator runs on Windows, Linux/X11 and Mac OS X desktop operating systems, and allows developers to create applications for multiple desktop and mobile device platforms. Also you may create Qt projects in Microsoft Visual Studio, but you will need to download a special utility for it. Every user can download all needed documentation and manuals from the official web site, or ask for help on forum. Qt provides you with all the functionality needed to develop advanced GUI applications on desktop and embedded platforms. Qt uses the native graphics APIs of each platform it supports, taking full advantage of system resources and ensuring that applications have native look and feel. OpenGL libraries and development tools also may be used in your Qt program to create attractive and powerful application, which includes 2D and 3D graphic.

In conclusion it is necessary to say, that Qt language despite of it “youth” has I great perspective for future PC and mobile programming. It takes into account the tendency of creating an application more attractive and at the same time has great performance on each OS or mobile device. Qt should be interesting for big corporation, because from this time they don't need to create different numerous copies of one software product (such as drivers or firmware) for each operation system. Finally, it should be noted that there aren't a lot of high qualified Qt programmers, so the knowledge of this language gives a possibility to get well paid job and wide opportunity to realize yourself in nearly any direction of today's IT sphere.

## **INTRODUCTION OF SOCIAL INFORMATION TECHNOLOGIES TO UKRAINIAN COMPANIES**

The rapid-changing conditions of modern economic environment stimulate world companies to improve the quality of internal and external communications. Considering the recent tendency of integration between corporative and social structures we ought to estimate the benefit of bringing social informational technologies into business. In our opinion, the global practice of using the following collaboration tools may be adopted to Ukrainian information and communication systems. For that assertion we will analyze the most efficient contemporary social informational systems.

**1. Social networking.** First introduced by Mark Zuckerberg in his famous *Facebook* project: a mean for people to provide, receive and exchange personal information, create groups of interests and make different kinds of arrangements. A company may use such a network in two main ways:

- Creating groups for employees in an intranet system. This provides security and efficacy to meetings, discussions and other kinds of teamwork, as well as a source of information on personnel for managers. For example, IBM is working on a whole virtual world for its employees' communication use.

- Using networking for marketing and outside collaboration. In such a way Procter & Gamble is searching and hiring specialists to improve their products.

**2. Wikis.** The term applies for a website that allows the simple creation and editing of interlinked web pages. It is often used to create collaborative wiki websites in corporate intranets. Benefits for a company are based on wiki's values:

- Provides means for outsourcing, gathers people with necessary talents and skills, enables co-creation of ideas and projects.

- Simplifies the process of presenting and editing projects, adds flexibility and efficient time management; minimizes e-mail use up to 75%.

- Enables direct access to changes for employees and following feedback from consumers.

**3. Twitter.** The idea is of a website with a service of microblogging—sharing information through short messages from various access points. Start-ups, i.e. *Yammer*, plan to upgrade Twitter's facilities for an enterprise's use. Advantages of microblogging lie in the following:

- Has a less disrupting nature in comparison with instant messages or telephone, provides bigger recipient auditory than e-mail;

- Decreases codification effort, provides a base to avoid an overload of information;

- Provides dynamic social interaction and gives opportunities for more effective management.

Enhancing of companies' success directly depends on fast adoption to changing conditions, which is possible by using new social informational technologies and communications.

## **CHAOS THEORY**

Chaos theory is a field of study in mathematics, physics, economics, and philosophy studying the behavior of dynamical systems that are highly sensitive to initial conditions. This sensitivity is popularly referred to as the butterfly effect. Small differences in initial conditions yield widely diverging outcomes for chaotic systems, rendering long-term prediction impossible in general. This happens even though these systems are deterministic, meaning that their future behavior is fully determined by their initial conditions, with no random elements involved. In other words, the deterministic nature of these systems does not make them predictable. This behavior is known as deterministic chaos, or simply chaos.

Although there is no universally accepted mathematical definition of chaos, a commonly used definition says that, for a dynamical system to be classified as chaotic, it must have the following properties: it must be sensitive to initial conditions, it must be topologically mixing and its periodic orbits must be dense.

Sensitivity to initial conditions means that each point in such a system is arbitrarily closely approximated by other points with significantly different future trajectories. Thus, an arbitrarily small perturbation of the current trajectory may lead to significantly different future behavior. Topological mixing (or topological transitivity) means that the system will evolve over time so that any given region or open set of its phase space will eventually overlap with any other given region. This mathematical concept of "mixing" corresponds to the standard intuition, and the mixing of colored dyes or fluids is an example of a chaotic system. Density of periodic orbits means that every point in the space is approached arbitrarily closely by periodic orbits. Topologically mixing systems failing this condition may not display sensitivity to initial conditions, and hence may not be chaotic. For example, an irrational rotation of the circle is topologically transitive, but does not have dense periodic orbits, and hence does not have sensitive dependence on initial conditions.

Chaotic behavior has been observed in the laboratory in a variety of systems including electrical circuits, lasers, oscillating chemical reactions, fluid dynamics, and mechanical and magneto-mechanical devices, as well as computer models of chaotic processes. Observations of chaotic behavior in nature include changes in weather, the dynamics of satellites in the solar system, the time evolution of the magnetic field of celestial bodies, population growth in ecology, the dynamics of the action potentials in neurons, and molecular vibrations. There is some controversy over the existence of chaotic dynamics in plate tectonics and in economics. A related field of physics called quantum chaos theory investigates the relationship between chaos and quantum mechanics. Recently, another field, called relativistic chaos has emerged to describe systems that follow the laws of general relativity. The motion of  $N$  stars in response to their self-gravity (the gravitational  $N$ -body problem) is generically chaotic.

Chaos theory is applied in many scientific disciplines: mathematics, programming, microbiology, biology, computer science, economics, engineering, finance, philosophy, physics, politics, population dynamics, psychology, and robotics. One of the most successful applications of chaos theory has been in ecology, where dynamical systems such as the Ricker model have been used to show how population growth under density dependence can lead to chaotic dynamics.

Information technology (IT) deals with the use of electronic computers and computer software in order to convert, store, protect, process, transmit, input, output, and retrieve information securely. Actually, information technology is the use of computers and software to manage information, so in some companies, this is referred to as Management Information Services (MIS) or simply put Information. Information technology complements and enhances traditional engineering through emphasis on the information basis for engineering. The knowledge and skills required in information technology come from the applied engineering sciences, especially information, computer, systems engineering sciences, and from professional practice.

The hardware and software of computing and communications form the basic tools for information technology. The main features of modern IT are:

1. Computer processing of information by a given algorithm.
2. Storage of the large amount of information on storage media.
3. Transfer of information on significant distances in a limited time.

IT professionals perform a variety of functions that range from installing applications to designing complex computer networks and information databases. A few of the duties that IT professionals perform may include data management, networking, engineering computer hardware, database and software design, as well as management and administration of entire systems. Information technology is starting to spread farther than the conventional personal computer and network technology, and more into integrations of other technologies such as the use of cell phones, televisions, automobiles, and more, which is increasing the demand for such jobs.

Information technology is concerned with improvements in a variety of human and organizational problem-solving endeavors through the design, development, and use of technologically based systems and processes that enhance the efficiency and effectiveness of information in a variety of strategic, tactical, and operational situations. Ideally, this is accomplished through critical attention to the information needs of humans in problem-solving tasks and in the provision of technological aids, including electronic communication and computer-based systems of hardware and software and associated processes.

The hardware and software of computing and communications form the basic tools for information technology. These are implemented as information technology systems through use of systems engineering processes.

It is important to consider the overall value chain in technology development projects, as the challenge for the value creation is increasing with the growing competitiveness between organizations.

Information Technology Departments will be increasingly concerned with data storage and management, and find that information security will continue to be at the top of the priority list.

## **ADAPTIVE TEACHING SYSTEMS BASED ON WEB TECHNOLOGIES**

In modern society with its fast and rapid technology growth problem of learning new information in time becomes more and more common. Amount of different information materials in different printed and electronic sources becomes enormous. To “remain in good shape”, modern person needs to orientate in this materials, study the necessary ones and be able to apply them in production or in office. For these purposes exists a lot of different education programs and online courses. As modern people are busy most of their time, they can not afford a lot of time for studying. Adaptive teaching systems (ATS) can become partial solution of this problem.

Adaptive teaching system is a system that forms its materials and teaching methods depending on personal qualities of the student. Most modern e-learning courses can not be called ATS because they realize older model of remote learning: materials are sent from teacher (or its imitation) to the student and then a test or another form of control examines the student's level of mastery of the material. This model does not consider person's free time periodicity, taste, perception level, personal qualities, etc. Based on this analysis, such requirements can be nominated to the ATS: individuality, all time availability, extensibility.

Internet today is not only HTML pages; it also can be used to watch online video, internet radio stations, read different illustrated articles, interact with web-applications. And user does not need to install different kinds of software: he only needs a web-browser, special program for displaying web-pages.

All Internet applications are based on “client-server” architecture. This means, that browser only makes a request, and all received information is formed by remote server, that can be situated somewhere far away. To communicate such programs use different protocols, like HTTP, FTP, etc. This type of architecture allows user to access his materials 24 hrs/day from any computer, which is connected to the Internet. Using remote server manages another important thing: because all materials are based at the server, user doesn't need to make a lot of unnecessary copies of these materials and doesn't need to bother keeping them up to date.

So, web-based adaptive teaching system can have following form: all training and related materials are placed into databases on servers, such as Oracle, MySQL, etc. Server logic is written in PHP, JSP, ASP or other popular server-oriented technology. Students must use modern web-browser, like Opera, Google Chrome, Mozilla Firefox, Internet Explorer, etc. It must support JavaScript, Adobe Flash and Cookies. After entering specific URL, user's browser sends a request to the server and receives HTML pages, JavaScript scripts, CSS styles, Flash content and presents all this to user in form of user-friendly interface with training materials in favorable form. If student has its profile in the system, the interface is formed in most suitable form for this student. Such process can be repeated many times, until course is complete.

Conclusion: modern web-technologies and their evolution can provide convenient and powerful tools for developing different projects and systems. New standards, protocols, technologies will change the form of the Internet and expand its social and semantic abilities.

## **INTERNET PROTOCOL VERSION 6**

The Internet Protocol (IP) is the principal communications protocol used for relaying packets across an internetwork using the Internet Protocol Suite. Responsible for routing packets across network boundaries, it is the primary protocol that establishes the Internet. The first major version of IP, now referred to as Internet Protocol Version 4 (IPv4) is the dominant protocol of the Internet, but today world community faces the problem- the 4.3 billion IPv4 Net addresses are now 95 percent used up.

Internet Protocol Version 6 (IPv6) is a new version of the Internet Protocol that is designed to succeed IPv4, the first publicly used IP in operation since 1981. IPv6 was developed by the Internet Engineering Task Force (IETF), and is described in Internet standard document RFC 2460, published in December 1998.

There are some major differences between IPv4 and IPv6:

1. Larger address space - the very large IPv6 address space supports a total addresses—or approximately addresses for each of the roughly 6.8 billion people alive in 2010. In another perspective, this is the same number of IP addresses per person as the number of atoms in a metric ton of carbon.

2. Simplified processing by routers - in IPv6, the packet header and the process of packet forwarding have been simplified to make packet processing by routers more efficient. The IPv6 header is not protected by a checksum; integrity protection is assumed to be assured by both link layer and higher layer (TCP, UDP, etc.) error detection. The TTL (time to live) field of IPv4 has been renamed to Hop Limit, so routers are no longer expected to compute the time a packet has spent in a queue.

3. Jumbograms - IPv4 limits packets to 65535 ( $2^{16} - 1$ ) bytes of payload. IPv6 has optional support for packets over this limit, referred to as jumbograms, which can be as large as 4294967295 ( $2^{32} - 1$ ) bytes and may improve performance over high-MTU (Maximum Transmission Unit) links.

The IPv6 packet is composed of two parts: the packet header and the payload. The header consists of a fixed portion with minimal functionality required for all packets and may contain optional extension to implement special features. The fixed header occupies the first 40 bytes of the IPv6 packet. It contains the source and destination addresses, traffic classification options, a hop counter, and a pointer for extension headers if any. The next header field, present in each extension as well, points to the next element in the chain of extensions. The last field points to the upper-layer protocol that is carried in the packet's payload. The payload can have a size of up to 64KiB without special options, or larger with a jumbo payload option in a Hop-By-Hop Options extension header.

The most important difference of IPv6 is addressing. IPv6 addresses are 128 bits long, compared to only 32 bits in IPv4. IPv6 addresses are written groups of four hexadecimal digits separated by colons, for example, 2001:db8:1f70::999:de8:7648:6e8. IPv6 addresses are logically divided into two parts: a 64-bit (sub-)network prefix, and a 64-bit interface identifier.

The difficulties of adopting the next-generation Internet standard so far have outweighed its advantages, but one key part of the computing industry is showing signs of beginning the IPv6 transition: Internet service providers show their active interest in IPv6.

### **ORTHOGONAL RECEPTION OF WIDEBAND SIGNALS**

Modern communication systems use wideband signals (WB). In real conditions an additive mixture WB and selective noise coming to the input of a receiving device often exceed the amplitude of a useful information signal [1]. The systems of recognition and processing signal analyze WB conditions on the basis of expected signal database. This method is easier than to filter the useful signal from noise.

The algorithm of orthogonal reception of digital signals is described in this research [2]. Walsh signals of the fourth and fifth diad were used here as WB signals.

The method of orthogonal reception consists of technical implementation of the formula:

$$\Lambda = 2 \int_0^T v(t) \sum_{k=1}^N a_{km} \cdot \Psi_k(t) dt - E_m = 2 \sum_{k=1}^N a_{km} \cdot a_k - E_m$$

where  $a_{km}$  - the expansion coefficients of orthogonal functions of m-th estimated signal;

$a_k$  - the expansion coefficients of orthogonal functions of a received signal;

$\Psi_k(t)$  - the basis of orthogonal functions;

$E_m$  - energy of expected signal  $w_m(t)$ .

In the research the algorithm of orthogonal reception of WB signals in the Matlab environment was obtained and elaborated. The analysis of operation of the algorithm on different obstacles was made. A comparative analysis of obtained results with the obtained results by receiving signals with correlation detector was put into practice [3,4]. The standard deviation for different diad of Walsh signals was estimated.

The advantages and disadvantages of using orthogonal reception of digital signals are considered.

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### **LEGISLATIVE REQUIREMENTS OF UKRAINE CONCERNING THE ORDER OF ADOPTION OF INNOVATIVE RADIOTECHNOLOGY**

In the condition of onrush technology in the world, we can observe the penetration of radio technology into the Ukrainian market. One of the biggest problems is to provide innovative technology with radiofrequency resource. Usually technical personnel tends to

underestimate this problem. Although the managers have to make considerable efforts to solve it.

The main regulatory documents operating companies have to follow in adoption of new technologies are the laws of Ukraine:

- Telecommunications Act
- Radiofrequency Resource Law of Ukraine.

These laws fix the order of adoption of new technology in Ukraine.

In compliance with this order the operator (company that provides services with new technology) has to solve the specific range of tasks.

1. The resolution of the NCCR (National Commission on Communication Regulation) of introducing new radiotechnology into the Plan of using radiofrequency resources in Ukraine. It may be necessary to come to agreement with Ministry of Defense of Ukraine about using radiofrequency resources. It also might be necessary to finance research engineering that validates the possibility of adoption of new technology in Ukraine at stated bandwidth.

2. Obtaining a license for using radiofrequency resources on the whole territory of Ukraine or in particular regions. In certain cases the license can be obtained on a competitive basis or it can be needed to deposit considerable tangible assets (money).

3. Deploying the equipment that ensures operation into the Register of Radio Electronic Equipment (REE) that can be used on the territory of Ukraine. In many cases, it is necessary to certify the equipment.

4. Planning radiofrequency and requesting for examination in the State Enterprise “Ukrainian State Centre of Radiofrequencies” (SE USCR) concerning EMC (ElectroMagnetic Compatibility) the announced REE with radiofrequency assignment. It may be necessary to come to agreement with Ministry of Defense of Ukraine and with Communication Authorities of neighboring countries.

5. Obtaining permission of SE USCR for operation with declared REE.

At the each of these stages applicant has to submit a set of documents fixed by Ukrainian laws defining time constraints of their consideration.

Such an approach to solving the problem of adoption of new radiotechnology is not so simple as supposed. But in most countries it becomes standard. Therefore assessment of possible to solve this problem should be taken into account for making the decision adoption of innovative technology in Ukraine.

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## **ALIGNMENT OF THE IT INFRASTRUCTURE WITH THE BUSINESS NEEDS**

In recent years, the industry is witnessing several significant trends that are changing the way companies think about their information technologies infrastructure and about how it should serve their business. One of the trends is the need for a greater alignment of the information technologies infrastructure with the business needs. A sample order management process is shown below. On arrival of a new order, and after the new order has been validated (checked for completeness and consistency), the provider carries out a credit check and the order would be subject to block until the requester’s credit is vetted. Once the credit check phase has been carried out, scheduling takes place. The order is divided up into order lines, which represent units of shipment. Depending on the inventory state on the provider side, some



of the order lines are committed and the schedule of their delivery takes place. Some of the order lines may not be committed because of temporary inventory shortage. For each order line, an acknowledgement signal is sent back to the counterpart. At this point a delivery note is created and the fulfillment stage begins. The order is transmitted through Electronic Data Interchange, which is the de facto standard for exchanging business documents (purchase order, invoice, shipping schedule, inventory inquiry) in a number of industries. The acknowledgment of commitment of order lines is also sent back to the requesting party through EDI. Most of the functionality needed for implementing this process can be supported by SAP application modules. SAP R/3 is used for order entry, incompleteness hold, and for extracting relevant information from the order lines to create delivery notes. Delivery notes are created through a legacy application. Functionalities such as order validation, credit check, availability check, procurement, and fulfillment are also supported through SAP either through user interfaces (manually executed steps) or through Web service interfaces. In addition, the order management process requires middleware for process execution, Web services support software and databases to store and log execution data. It is clear that business alignment and adaptability require changes in the information technologies infrastructure in much shorter time scales than is done today, including in particular the coordinated changes to these parameters to improve business goals. The only way to deal with this complexity in a dynamic environment is to rely on automation. It is impossible to manually manage this complexity, both because of the number of factors involved in making decisions and because these decisions must sometimes be taken on the fly and enacted right away, and not offline. Hence, many of the operational tasks that are typically carried out by human operators need to be streamlined and automated. Automation is needed in all phases of the IT lifecycle – from provisioning to monitoring, decision making, and controlling – and in all layers of the stack. Besides enabling better management, automation also enables new opportunities and allows the same data center to support multiple customers.

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**CSS3**

Cascading Style Sheets (CSS) is a style sheet language used to describe the presentation semantics (the look and formatting) of a document written in a markup language such as HTML (HyperText Markup Language) and XML (Extensible Markup Language). CSS has various levels and profiles. Each level of CSS builds upon the last, typically adding new features and typically denoted as CSS1, CSS2 and CSS3. Profiles are typically a subset of one or more levels of CSS built for a particular device or user interface. CSS level 3 has been under development since December 15, 2005. The World Wide Web Consortium (W3C) maintains a CSS3 progress report. Cascading Style Sheets level 3 is modularized and consists of several separate recommendations.

There are exciting new features in the pipeline for Cascading Style Sheets that will allow for an explosion of creativity in Web design. These features include CSS styling rules that are being released with the upcoming CSS3 specification. W3C has offered some new options for borders in CSS3 such as border-image, border-radius, border-color. For example, the border-radius property allows web developers easily utilize rounder corners in their design elements, without the need for corner images or the use of multiple div tags, and is perhaps one of the most talked about aspects of CSS3. There are new features for backgrounds such as

background-origin (used to determine how the background-position of a background in a certain box is calculated), background-clip (used to determine whether the backgrounds extends into the border or not), background-size (used for specifying the size of background images), multiple backgrounds (used for separating background images on one element). CSS3 supports more color and a wider range of color definitions. The new colors that CSS3 support are HSL (hue, saturation, lightness), CMYK (cyan, magenta, yellow, black), HSLA (hue, saturation, lightness, alpha) and RGBA (red, green, blue, alpha). The Multiple Columns CSS3 module allows to create multi-column texts without adding table using -moz-column-count and -moz-column-width. The box-shadow property allows designers to easily implement multiple drop shadows (outer or inner) on box elements, specifying values for color, size, blur and offset. There are another features such as text-shadow, text-overflow, word-wrap, box-sizing, resize, outline, nav-top, nav-right, nav-bottom, nav-left, overflow-x, overflow-y etc. The advanced selectors are the most exciting development of CSS in CSS3. This feature gives power to select every third table row starting with the fifth one

With CSS3, many exciting features will be implemented. CSS3 leads to greater flexibility and makes it much easier to recreate previously complex effects. Many time-saving rules are being thought up for CSS3. Although only the most modern browsers supports these effects. It will still take a while before CSS3 is complete, even longer till every browser supports it. CSS3 opens up new avenues for design and creativity on the web, with the ability to better control the display of content through the browser.

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### **VSAT TECHNOLOGY**

A Very Small Aperture Terminal (VSAT), is a two-way satellite ground station or a stabilized maritime Vsat antenna with a dish antenna that is smaller than 3 meters. The majority of VSAT antennas range from 75 cm to 1.2 m. Data rates typically range from 56 Kbit/s up to 4 Mbit/s. VSATs access satellites in geosynchronous orbit to relay data from small remote earth stations (terminals) to other terminals (in mesh configurations) or master earth station "hubs" (in star configurations). VSATs are most commonly used to transmit narrowband data (point of sale transactions such as credit card, polling or RFID data; or SCADA), or broadband data (for the provision of Satellite Internet access to remote locations, VoIP or video). VSATs are also used for transportable, on-the-move (utilising phased array antennas) or mobile maritime communications.

The first commercial VSATs were C band (6 GHz) receive-only systems by Equatorial Communications using spread spectrum technology. More than 30,000 60 cm antenna systems were sold in the early 1980s. The largest VSAT network (more than 12,000 sites) was deployed by Spacenet and MCI for the US Postal Service. Most VSAT networks are configured in one of these topologies: a star topology, using a central uplink site, such as a network operations center (NOC), to transport data back and forth to each VSAT terminal via satellite; a mesh topology, where each VSAT terminal relays data via satellite to another terminal by acting as a hub, minimizing the need for a centralized uplink site; a combination of both star and mesh topologies. Some VSAT networks are configured by having several centralized uplink sites (and VSAT terminals stemming from it) connected in a multi-star topology with each star (and each terminal in each star) connected to each other in a mesh

topology. Others configured in only a single star topology sometimes will have each - terminal connected to each other as well, resulting in each terminal acting as a central hub. These configurations are utilized to minimize the overall cost of the network, and to alleviate the amount of data that has to be relayed through a central uplink site (or sites) of a star or multi-star network. FSS satellite systems currently in orbit have a huge capacity with a relatively low price structure. FSS satellite systems provide various applications for subscribers, including: telephony, fax, television, high speed data communication services, Internet access, Satellite News Gathering (SNG), Digital Audio Broadcasting (DAB) and others. These systems are applicable for providing various high-quality services because they create efficient communication systems, both for residential and business users.

Maritime VSAT is the use of satellite communication through a VSAT terminal on a ship at sea. Since a ship at sea moves with the water the antenna needs to be stabilized with reference to the horizon and True North, so that the antenna is constantly pointing at the satellite it uses to transmit and receive signals.

Currently, the largest VSAT network consists of over 12,000 sites and is administered by Spacenet and MCI for the US Postal Service (USPS). Walgreens Pharmacy, Dollar General, CVS, Riteaid, Wal-Mart, Yum! Brands (such as Taco Bell, Pizza Hut, Long John Silver's, and other fast food chains), GTEC, SGI, and Intralot also utilizes large VSAT networks. Many huge car corporations such as Ford and General Motors also utilizes the VSAT technology, such as transmitting and receiving sales figures and orders, along with announcing international communications, service bulletins, and for distance learning courses.

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## **CELL PHONE FOR THE BLIND**

In present time cell phones have many different functions such as player, GPS navigator, camera, dictaphone, Internet browser. They equipped with large touchscreens. They are managed with processors near 1Ghz and RAM near 1GB, which allow you to use different programs to facilitate our lives.

But these functions can't be used by the blind people. They also use cell phones and have problems with dialing of many numbers, ignorance of the battery charge, the balance on the account and etc. This is not the first attempt to create a phone for the blind. Once, LG introduced a mobile phone with advanced voice features, read aloud books, and offered advanced voice control. Later the original concept from Peter Lau was introduced, in which the keys were of special form that allowed the blind to dial the number. There were a lot of other attempts.

Recently, a new cell phone that could give the blind users the same kind of multifunctional opportunities that the iPhone users enjoy has appeared.

The new cell phone, called B-Touch, is based on the touchscreen technology for the blind and uses a touchscreen display for Braille. Including voice systems and programs to function as a phone, the B-Touch also supports a system for navigation, a book reader and an object recognizer. Controlling with B-Touch can be done sensory and voice.

When the cell phone is in standby, the time, date, weather and temperature in Braille are written on the screen. If user switches to a set mode, he will see the usual number

keyboard in Braille. When B-Touch has an incoming call it speaks out a name or number of the caller.

Also B-Touch has functions as a reader. User should turn a special mode and sliding text with scanner, which is found on the one side of the phone, then B-Touch can translate the text into Braille or speak out.

B-Touch can tell the destination of the user, it can also inform how to get to the desired destination (the bus station or etc.). B-Touch works like scanner, it tells what barrier are in front of the user, inform the bumpiness of the road (concave or convex), it can notify blind person in voice or through vibration.

B-Touch can recognize an object with a camera comparing image with data bank, when there are similar images in B-touch, it will tell you what that is and its colour. It recognizes not only the standard geometric shapes, but different usual things such as: apple, bottle and etc.

The advantages of B-Touch are obvious. This device already exists, although not in serial sales and in the near future not expected yet. But this phone will allow blind people to stay in touch and don't limit them in communication. It will help them both on work and in entertainments. Also they won't have problems to know the time, date, weather or temperature. They will be able to read any documents and books, find the desired object on the table. To go somewhere or to get home will not be a problem for them any more. They will become closer with the outside world.

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### **ANONYMOUS ELECTRONIC PAYMENT SYSTEMS**

The number of private and corporate financial transactions that are done electronically is growing rapidly. From a user's point of view, efficiency and flexibility are clear advantages of existing and emerging electronic payment systems. Due to technical progress (e.g. powerful smart cards) and new developments in cryptology, these systems offer also a high level of security.

Usually, the security of electronic payment systems is realized by a combination of physical measures and cryptologic methods. Below an electronic payment system that provides payer's anonymity is described.

Electronic payment systems offering no anonymity can easily be realized. The simplest example is a system in which payments are done by simultaneously debiting the payer's account and crediting the payee. The security of such a system is based on the authentication of the payer as the owner of the debited account; this means that the security does not need to rely on physical measures. There also exist systems offering anonymity, for instance systems using numbered bank accounts, which have been introduced in some countries.

The basic idea of the system which is described is to combine the two systems mentioned above in order to have the independence of physical security of the former and the anonymity of the latter. A customer has a regular account with the bank and is the owner of one or several anonymous accounts. Actually, anonymous accounts are similar to numbered bank

accounts. The customer can pay with the regular account, if no anonymity is desired, and with an anonymous account, if the individual's identity should not be disclosed.

In the first step, the customer withdraws money from the regular account and receives from the bank a digital attestation. Then he or she can use this attestation to pay the withdrawn money into the anonymous account.

The following properties of this attestation are fundamental for the security of the system:

- It must be impossible to forge an attestation because this is equivalent to forging money.
- The attestation must not reveal the identity of the payer.
- It must be impossible to use the attestation more than once to pay money into an account.

Because the system does not rely on any physical security measure, it is possible to make backup-copies of all attestations. Therefore, if a smart card containing such attestations is lost, it is possible to restore the attestations in another card. Even if a thief obtains the attestations, he or she could only use them for the intended anonymous accounts.

This system can be realized as an extension of today's EFTPOS systems, since there is no significant difference between a payment involving an anonymous account and a regular account.

For legal reasons, the bank could be led to control the origin of money paid into an account. In the case of a regular account, this can be done with the usual assortment of administrative measures.

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## **BEAM SYNTHESIS PROPAGATION**

CODE V is a commercial software package developed by Optical Research Associates. It is used for the design and analysis of optical imaging and optical communication systems. One of latest innovation created by this team is Beam Synthesis Propagation (BSP).

BSP's beamlet-based wave propagation algorithm was designed to deliver extremely accurate modeling of diffracted wavefronts propagating through almost any optical system. BSP works well with systems in which the more common FFT-based diffraction calculations are less accurate or fail completely. It can propagate scalar or vector fields through any object that can be ray traced, such as GRIN materials, birefringent materials, and non-sequential surface ranges.

Optical Research Associates originally developed BSP for NASA to solve the stringent accuracy challenges of the Terrestrial Planet Finder mission. BSP met the mission's requirements with its ability to accurately model irradiance that distinguished a very dim, Earth-like planet outside our solar system from the surrounding stars.

BSP uses a beamlet-based diffraction propagation algorithm that models the wave nature of light through the entire optical system. The input beam can be modeled as an apodized spherical or plane wave, or a Gaussian beam. BSP includes diffraction effects caused

by factors such as aperture clipping, ray-wave disconnects (i.e., slow beams), intermediate image structure, and lens aberrations. It delivers greater accuracy than using exit-pupil diffraction computations, or beam propagation based on FFT or angular spectrum methods.

BSP approximates the optical field as a collection of individual beamlets. A beamlet consists of a base ray and a field that is initially localized about the base ray. The base ray defines the reference location and direction for each beamlet.

Based on the fact that the wave equation is linear, these beamlets are propagated independently and can be summed anywhere downstream to get the propagated optical field. This method can propagate beams through anything that can be ray traced.

BSP's beamlet-based algorithm is unique in its ability to propagate fewer beamlets than other beamlet-based approaches, while achieving a more accurate result

BSP provides textual and graphical output that allows you to easily visualize and understand results. The output can represent a variety of quantities associated with the field at different surfaces, including amplitude, phase, intensity, and irradiance.

Systems with astigmatic beams, polarized input optical fields, low f-numbers (e.g., microlithography lenses), or non-contiguous pupils are accurately analyzed with BSP. The feature is also useful for near-field diffraction analysis and for optical systems where the amplitude or phase is modified near the focus, such as with a grating, phase plate, or spatial filter.

BSP supports multiple wavelengths and polarization, so systems with dispersive materials, metallic surfaces, and multilayer coatings, as well as beamsplitters and polarizers, are accurately analyzed.

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## **INTRUSION DETECTION SYSTEM**

Intrusion detection (ID) is a type of security management system for computers and networks. An ID system gathers and analyzes information from various areas within a computer or a network to identify possible security breaches, which include both intrusions (attacks from outside the organization) and misuse (attacks from within the organization). ID uses vulnerability assessment (sometimes referred to as scanning), which is a technology developed to assess the security of a computer system or network.

A preliminary concept of an IDS began with James P. Anderson and reviews of audit trails. An example of an audit trail would be a log of user access. Fred Cohen noted in 1984 (see Intrusion Detection) that it is impossible to detect an intrusion in every case and that the resources needed to detect intrusions grows with the amount of usage.

For the purpose of dealing with IT, there are two main types of IDS:

- Network intrusion detection system (NIDS) - an independent platform that identifies intrusions by examining network traffic and monitors multiple hosts. Network intrusion detection systems gain access to network traffic by connecting to a network hub, network switch configured for port mirroring, or network tap. In a NIDS, sensors are located at choke points in the network to be monitored, often in the demilitarized zone (DMZ) or at network borders. Sensors capture all network traffic and analyze the content of individual packets for malicious traffic. An example of a NIDS is Snort.

- Host-based intrusion detection system (HIDS) - consists of an agent on a host that identifies intrusions by analyzing system calls, application logs, file-system modifications (binaries, password files, capability databases, Access control lists, etc.) and other host activities and state. In a HIDS, sensors usually consist of a software agent. Some application-based IDS are also part of this category. An example of a HIDS is OSSEC.

Intrusion detection functions include:

- Monitoring and analyzing both user and system activities
- Analyzing system configurations and vulnerabilities
- Assessing system and file integrity
- Ability to recognize patterns typical of attacks
- Analysis of abnormal activity patterns
- Tracking user policy violations

ID systems are being developed in response to the increasing number of attacks on major sites and networks, including those of the Pentagon, the White House, NATO, and the U.S. Defense Department. The safeguarding of security is becoming increasingly difficult, because the possible technologies of attack are becoming ever more sophisticated; at the same time, less technical ability is required for the novice attacker, because proven past methods are easily accessed through the Web.

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## **FTTH NETWORK ARCHITECTURE**

With recent widespread use of the Internet at home, the traditional network communication lines are gradually unable to deliver the increasing amount of data, such as audio data, image data and movie data via the Internet. In order to satisfy these demands, FTTH (Fiber To The Home), in which optical fibers are provided to the home are being made available to consumers. FTTH delivers faster broadband access compared to existing access technologies including network connections based on phone lines (DSL) or coaxial cable. Optical fiber has become the medium of choice for sending digital signals between the central office and remote terminals. Optical fibers form some of the main lines through which telecommunications data is connected all over the world. An optical fiber typically includes a core region surrounded concentrically by a cladding. The optical fiber bidirectional communication achieved by using a single optical fiber through which two types of light signals with different wavelengths are propagated bidirectionally has become increasingly common in optical communication applications such as FTTH. The bidirectional communication may be achieved by inputting light with two different wavelengths to a single optical fiber. In Fiber To The Home (FTTH), optical signal capabilities are routed from a central office or other distribution location to a plurality of homes in that particular location via optical fiber and one or more optical connectors and other optical connection devices.

While FTTH is by far the most impressive and feature-filled technology, the likeliness of it ever reaching a wide audience isn't very high, at least not in the near future. Many leading telecommunication companies around the world have decided to merge into a pure IP network in the near future for data and voice, which will fuel the expansion of FTTH. However, FTTH is very much viewed as a technology for new estates and areas, not necessarily current

establishments. For those who will be able to use FTTH in the near future, you can probably expect telephone, broadband, TV and other services delivered by a conventional high-speed connection directly to your doorstep. But it will be a very long time before this makes any sort of widespread impact.

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## **GRAPHIC INFORMATION TECHNOLOGIES. 3D VISION SURROUND**

Information technology - is a combination of methods, processes, software and hardware that are incorporated in the processing chain, that provides collection, processing, storage, transmission and display of information.

The purpose of this chain is to reduce labor intensity of the information resources usage and to improve their reliability and efficiency. The effectiveness of information technology is determined, ultimately, by skill subjects informatization processes. Meanwhile, this technology should be accessible to consumers.

Information technology can be distinguished by the type of information processed. Let's take graphics as an example. One of the innovations in this area is the technology of 3D Vision Surround.

It is known that in early January 2010 at CES exhibition, NVIDIA announced its new technology - 3D Vision Surround. This technology realizes the possibility of stereoscopic view of video, photos, and games with special 3D glasses, consisting of three monitors. NVIDIA itself asserts that the use of 3D Vision Surround technology gives users a unique experience in a videogame. 3D Vision Surround technology allows you to display stereoscopic images through three monitors connected to video card NVIDIA. Naturally, that the first to support the technology of a new line were graphics cards GTX 400. But unlike ATI, NVIDIA made 3D Vision Surround compatible with graphics solutions of past generation. This means that users who have high-end GTX 200 graphics card will also be able to take advantage of this technology. However, experts have expressed doubts about the effectiveness of this development. The user sits in front of three monitors and forced to keep under review all three images.

In order to achieve more or less acceptable results with using of 3D Vision Surround, the user must be in front of the monitor at least half a meter, which is not always convenient. Also, one should not forget about the price. To implement the NVIDIA technology user would have to acquire three 3D monitors with a frequency sweep of 120 Hz, and stereoscopic goggles. This is a very expensive equipment.

Technology 3D Vision Surround also ignores your setting v-sync, displaying the game with a frame rate of 120 Hz, so that each eye receives 60 frames per second. As a result, the highest frame rate is 60 fps. AFR technology for NVIDIA adds some computational load, so the frame rate is not higher than 52 fps. So the gameplay can be quite comfortable. But don't expect to run this system using Windows XP. Your operating systems needs to be either the 32-bit or 64-bit version of Windows 7. Once you've got that, an SLI capable motherboard is required.



Multi-rival ATI Eyefinity technology does not offer 3D effects, but its implementation is several times cheaper. Among other things, the normal operation of 3D Vision Surround requires a very powerful graphical configuration of Quad SLI, as this technology is very resource intensive. This is brilliantly confirmed by tests conducted by the resource CZechgamer.

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### **BLADE-SERVERS (BLADES): ADVANTAGES, SHORTCOMINGS AND APPLICATION**

In any company which are doing business in dynamical conditions of the modern market, every day there are requirements for introduction of new services and applications for manufacture which will adapt with minimal time and material inputs. Naturally, with increase in requirements necessity of escalating of computing capacities of the equipment increases also, charges on the equipment, its service, a power and air-conditioning also grow. But some companies at growth of computing capacities manage to reduce the charges listed above, owing to application in IT-structure of blade-servers.

Blade-servers have started to appear in the world in the end of the last century, but the beginning of successful commercial use is necessary on the beginning of XXI century. On internal filling the blade practically does not differ from habitual all of servers - the processor, memory, a hard disk or a network adapter, depending on a variant of loading, are grouped in the compact case which is installed in the chassis. And here outside a blade - in the chassis, there are the elements which are responsible for power supplies, cooling, network connections, monitoring and management of servers. The economy on air-conditioning and power supplies is achieved by association in the chassis of the elements necessary simultaneously for all blades. Owing to high density accommodation of hardware components in a blade and the chassis disappears necessity for big sizes of server rooms. For monitoring and service of the equipment is not present necessity to contain the big staff of technical experts. Modularity decisions improve fault-tolerance, scalability and flexibility of system as a whole.

Besides positive aspects of blade-systems, there are also shortcomings. One of the cores is an absence of the general standard, each of manufacturers produced servers compatible exclusively with the chassis. Also this presence of a uniform point of failure in the form of the chassis that entails, in case of failure, idle time of all servers. But it is necessary to realize, that the chassis is a passive element which can be damaged only mechanically by transportation or installation, and all contact groups between servers and modules of input/output, certainly, are reserved.

It is necessary to note and low efficiency of use blades at the decision of noncritical tasks. If in the company for job low-power servers are required only some to get the chassis in which two thirds of free slots will stand idle - is economically inexpedient.

The limited volume of internal space is more necessity, than lack, in fact the majority of blades are used for problems of virtualization with use of an external disk file, but if necessary there are slots of expansion where it is possible to install additional processors, memory, hard disks and PCI adapters.

By today's estimations, among are presented in the market of productions of blade-systems about half these are blade-systems of production Hewlett-Packard, a quarter - IBM and the second quarter divide among themselves Dell, Fujitsu Siemens Computers and Sun.

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## **MOBILE BROADBAND**

The technology for mobile broadband has reached a tipping point-the point where wireless networking technology allows for speeds fast enough for high-value applications, where mobile devices are fast and powerful, and where the cost of the devices and services are affordable to a large segment of the population. As a result, ubiquitous connectivity is likely to emerge as one of the defining attributes of the Internet economy over the next quarter century. The mobile Internet untethers users so they can enjoy the benefits of the Internet from anywhere. And the result will be an array of applications, services, and devices available to improve people's quality of life, enhance productivity for organizations, and provide the foundation for entirely new business models that could not exist without the mobile internet.

Mobile broadband today is the result of convergence between the cellular telephone networks and the Internet, two networks which evolved along very different parts. While 3G networks were designed primarily for voice, 4G networks are being designed for data. Moreover, 4G networks like LTE and WiMax offer download and upload speeds that rival many wired broadband connections, although exact speeds and coverage of 4G networks very based on factors influencing signal propagation like frequency, antenna height and geography. However, next-generation mobile broadband networks are not just about increasing speed, they are also about increasing performance with lower packet loss, lower latency, and increased capacity. As a result, consumers will soon be able to run multiple, real-time applications, such as streaming video, over mobile networks.

The mobile internet is already available in many places, including cars, trains, and airplanes, but cost, speed, and availability are still barriers to wider adoption. Wider deployment of 4G wireless technologies such as LTE or WiMax and their successors will help create the foundation for new applications, services and devices, as the mobile speeds of tomorrow will equal or exceed the wired speeds of today. Increasingly the mobile Internet will be about much more than surfing a Web site while sitting in a park; it will enable engagement in a wide array of Internet-enabled activities and transactions.

One important source of innovations will likely be in more implementation and use of location-based services. Location data can be used to improve the quality of search, communication tools, social networking, games, applications and targeted advertising. As applications like Twitter integrate geo-location metadata with user-generated content, other users can use location-aware applications that allow them to find data submitted by others in a specific location.

## **UNCLOUDED HAPPINESS WITH CLOUD COMPUTING**

Cloud computing is Internet-based computing, whereby shared resources, software and information are provided to computers and other devices on demand, like the electricity grid. Cloud computing describes a new supplement, consumption, and delivery model for IT services based on the Internet, and it typically involves over-the-Internet provision of dynamically scalable and often virtualized resources.

Cloud computing users avoid capital expenditure on hardware, software, and services when they pay a provider only for what they use. Consumption is usually billed on a utility or subscription basis with little or no upfront cost. Also there are low barriers to entry, shared infrastructure and costs, low management overhead and immediate access to a broad range of applications.

Most cloud computing infrastructures consist of services delivered through common centers and built on servers.

Main features of cloud computing are agility, cost, device and location independence, multi-tenancy, reliability, scalability, security, maintenance, metering.

Cloud platform services or deliver a computing platform and solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications.

Deployment models are divided into public cloud, community cloud, hybrid cloud, private cloud.

Cloud application services or "Software as a Service (SaaS)" deliver software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support. People tend to use the terms 'SaaS' and 'cloud' interchangeably, when in fact they are two different things.

Security is always an important problem. Is it more dangerous to have your email on ukr.net's servers or your personal conversations on social network? IT security is about trust. You have to trust your CPU manufacturer, your hardware, operating system and software vendors and your provider. Cloud providers have systems in place to prevent data leaks or access by third parties. Proper separation of duties should ensure that auditing and monitoring cannot be defeated, even by privileged users at the cloud provider.

Most cloud providers expose APIs which are typically well-documented but also unique to their implementation and thus not interoperable.

When software and cloud computing services come from the same source, problems become their problems, not problems of costumers.

For illustration, it will be very useful to have a little cloud for each faculty or even group of students. Imagine there are a lot of interesting information about this or that subject and students have to exchange it with each other and have to make some changes (in deciding a problem/homework). It will be a long process of copy and paste. Also different people have different computer software. But if we have a cloud, we can easily decide all this and some other problems and always be informed.

We can find and list thousands of examples but it will be better begin usage of cloud computing immediately.

## **FIBER OPTIC CABLE**

You hear about fiber-optic cables whenever people talk about the telephone system, the cable TV system or the Internet. Fiber-optic lines are strands of optically pure glass as thin as a human hair that carry digital information over long distances. They are also used in medical imaging and mechanical engineering inspection.

An optical fiber is a thin, flexible, transparent fiber that acts as a waveguide, or "light pipe", to transmit light between the two ends of the fiber.

A single optical fiber has the following parts:

- Core - thin glass center of the fiber where the light travels;
- Cladding - outer optical material surrounding the core that reflects the light back into the core;
- Buffer coating - plastic coating that protects the fiber from damage and moisture.

Hundreds or thousands of these optical fibers are arranged in bundles in optical cables. The bundles are protected by the cable's outer covering, called a jacket.

Optical fibers come in two types: single-mode fibers and multi-mode fibers.

Single-mode fibers have small cores (about 9 microns in diameter) and transmit infrared laser light (wavelength = 1,300 to 1,550 nanometers). Multi-mode fibers have larger cores (about 62.5 microns in diameter) and transmit infrared light (wavelength = 850 to 1,300 nm) from light-emitting diodes (LEDs).

The light in a fiber-optic cable travels through the core by constantly bouncing from the cladding, a principle called total internal reflection. Because the cladding does not absorb any light from the core, the light wave can travel great distances.

Compared to conventional metal wire (copper wire), optical fibers are:

- Less expensive - several miles of optical cable can be made cheaper than equivalent lengths of copper wire;
- Thinner - optical fibers can be drawn to smaller diameters than copper wire;
- Higher carrying capacity - because optical fibers are thinner than copper wires, more fibers can be bundled into a given-diameter cable than copper wires;
- Less signal degradation - the loss of signal in optical fiber is less than in copper wire;
- Light signals - unlike electrical signals in copper wires, light signals from one fiber do not interfere with those of other fibers in the same cable;
- Low power - because signals in optical fibers degrade less, lower-power transmitters can be used instead of the high-voltage electrical transmitters needed for copper wires;
- Lightweight - an optical cable weighs less than a comparable copper wire cable;
- Flexible - Because fiber optics are so flexible and can transmit and receive light, they are used in many flexible digital cameras.

Because of these advantages, you see fiber optics in many industries, most notably telecommunications and computer networks.

### **WI-FI SECURITY**

Wi-Fi is short for wireless fidelity and is meant to be used generally when referring to any type of IEEE 802.11 standard network, whether 802.11b, 802.11a, dual-band, etc. IEEE 802.11 is a set of standards carrying out wireless local area network (WLAN) – that's what we mean under "Wi-Fi network" term indeed. Wi-Fi allows us to organize different private or public wireless networks in different scales, provide internet access and control different compatible devices.

Wi-Fi has its own advantages and disadvantages, but its security (which is among main disadvantages) deserves separate attention. The main issue with wireless network security is its simplified access to the network compared to traditional wired networks such as Ethernet. And it would not be a problem if this simplified access wasn't in most cases secured by several times weaker encryption standards or wasn't secured at all.

The most common wireless encryption standard, Wired Equivalent Privacy (WEP), has been shown to be unsteady even when correctly configured. Wi-Fi Protected Access (WPA and WPA2) encryption, which became available in devices in 2003, aimed to solve this problem, but it didn't – weak WEP encryption is still alive and well.

Problem roots are based on a fact, that Wi-Fi access points typically default to an encryption-free (open) mode. Novice users benefit from a zero-configuration device that works out-of-the-box, but this default does not enable any wireless security, providing open wireless access to a LAN. To turn security on requires the user to configure the device, usually via mostly old software GUI but this task is quite complicated to an ordinary user.

On unencrypted Wi-Fi networks connecting devices can monitor and record data (including personal information), but such networks could use other means of protection, such as a virtual private network (VPN) or secure Hypertext Transfer Protocol (HTTPS) and Transport Layer Security. Using them is obligatory if you really want to protect your data and not only in WLAN. VPN encapsulates data transfers between two or more networked devices which are not on the same private network so as to keep the transferred data private from other devices on one or more intervening local or wide area networks. There are many different classifications, implementations, and uses for VPNs. Hypertext Transfer Protocol Secure (HTTPS) is a combination of the Hypertext Transfer Protocol with the SSL/TLS protocol to provide encrypted communication and secure identification of a network web server. HTTPS connections are often used for payment transactions on the World Wide Web and for sensitive transactions in corporate information systems.

### **SMART HOUSE**

A smart house is a house that has highly advanced automatic systems for lighting, temperature control, multi-media, security, window and door operations, and many other functions.

The term Smart House was coined in 1984 by the National Association of Home Builders (NAHB), but smart home technology was developed in 1975, when a company in Scotland developed X10. X10 allows compatible products to talk to each other over the already existing electrical wires of a home. All the appliances and devices are receivers, and the means of controlling the system, such as remote controls or keypads, are transmitters.

A smart home appears "intelligent" because its computer systems can monitor so many aspects of daily living. For example, the refrigerator may be able to inventory its contents, suggest menus, recommend healthy alternatives, and order groceries. The smart home systems might even take care of cleaning the cat's litter box and watering the plants.

For a more cost-effective smart-house solution, it is possible to install smart-house software. Smart-house software has the ability to turn home appliances off and on by using the existing wiring in the house. Smart-house software offers the ability to run appliances, access the Internet for weather, stock market, or other information, all using voice commands.

Smart home becoming increasingly sophisticated. Coded signals are sent through the home's wiring to switches and outlets that are programmed to operate appliances and electronic devices in every part of the house. Home automation can be especially useful for elderly and disabled persons who wish to live independently, for people who want to spend more time pursuing life's rewards and less time performing routine household tasks.

Instead of going through the power lines, some systems use radio waves to communicate, which is also how WiFi and cell phone signals operate. However, home automation networks don't need all the juice of a WiFi network because automation commands are short messages. The two most prominent radio networks in home automation are ZigBee and Z-Wave. Both of these technologies are mesh networks, meaning there's more than one way for the message to get to its destination.

Also, hackers who access the network will have the ability to turn off alarm systems and lights, leaving the home vulnerable to a break-in, or the theft could be more electronic.

The Smart House technology would adjust the power supplied to each appliance according to need. In the traditional scheme, each appliance is provided with sufficient power to provide for its peak use. In addition, the Smart House controllers could schedule the operation of heavy power consuming appliances (such as dishwashers, electric water heaters, and air conditioners) to take maximum advantage of off-peak electric rates. These adjustments could result in lower utility costs.

Home automation devices are available, but they require a lot of hard work, and the end result is a remote-control house — not a futuristic robotic companion. With the development of new electronic technologies and their integration with older, traditional building technologies, the intelligent home is at last becoming a real possibility.

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## **WIMAX**

WIMAX (Worldwide Interoperability for Microwave Access) is a telecommunications protocol that provides fixed and fully mobile Internet access. The current WIMAX revision provides up to 40 Mbit/s. The name "WIMAX" was created by the WIMAX

Forum, which was formed in June 2001 to promote conformity and interoperability of the standard. The forum describes WIMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL". The bandwidth and range of WIMAX make it suitable for the following potential applications:

1) providing portable mobile broadband connectivity across cities and countries through a variety of devices; 2) providing a wireless alternative to cable and DSL for "last mile" broadband access; 3) providing data, telecommunications (VoIP) and IPTV services (triple play); 4) providing a source of Internet connectivity as part of a business continuity plan.

Companies are deploying WIMAX to provide mobile broadband or at-home broadband connectivity across whole cities or countries. In many cases this has resulted in competition in markets which typically only had access to broadband through an existing incumbent DSL (or similar) operator.

HTC announced the first WIMAX enabled mobile phone, the Max 4G, on Nov 12th 2008. The device was only available to certain markets in Russia on the Yota network.

HTC released the second WIMAX enabled mobile phone, the EVO 4G, March 23, 2010 at the CTIA conference in Las Vegas. The device made available on June 4, 2010 is capable of both EV-DO(3G) and WIMAX(4G) as well as simultaneous data & voice sessions. The device also has a front-facing camera enabling the use of video conversations. A number of WIMAX Mobiles are expected to hit the US market in 2010.

Comparisons and confusion between WIMAX and Wi-Fi are frequent because both are related to wireless connectivity and Internet access.

- WIMAX is a long range system, covering many kilometres, that uses licensed or unlicensed spectrum to deliver connection to a network, in most cases the Internet.
- Wi-Fi uses unlicensed spectrum to provide access to a local network.
- Wi-Fi is more popular in end user devices.
- Wi-Fi runs on the Media Access Control's CSMA/CA protocol, which is connectionless and contention based, whereas WIMAX runs a connection-oriented MAC.

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## **FREE SPACE OPTICS**

Free Space Optics (FSO) is a line of sight technology that uses invisible beams of light to transmit data from point-to-point and multipoint. FSO systems can be a good solution for some broadband networking needs. It offers the speed of fiber with the flexibility of wireless.

The use of light is a simple concept similar to optical transmissions using fiber-optic cables. The only difference is the medium. Light travels through air faster than it does through glass, so it is fair to classify FSO technology as optical communications at the speed of light.

For wireless optical communication channel, you must install transceiver laser systems on buildings of remote offices which are placed in direct line of sight of each other. In this case, the equipment shall be rigidly fixed to avoid vibrations that could disrupt the focus of the beam.

Most frequently, laser beams are used, although non-lasing sources such as light-emitting diodes (LEDs) or IR-emitting diodes (IREDS) will serve the purpose.

Usually, the light-emitting systems operate in the range 700-950 nm (approx 315-428 THz).

Lately appeared devices aimed at ranges of 1300 and 1550 nm, which ensures compatibility with fiber optic DWDM-systems.

Modern FSO device allows for a data transfer speed of several Gbps. In the laboratory have already reached speeds of 160 Gbps. Maximum range for terrestrial links is in the order of 2 to 3 km.

This technology has some advantages such as the simplicity of installation, highly secure due to narrow transmission beam, immunity to radio frequency interference or saturation. It is more cheaper compared with other high-speed solutions. And unlike radio frequencies, FSO technology does not require a spectrum license. Because the frequency of the radiation of many laser systems is far beyond the limits of controlled radio range 400-600 GHz.

The stability and quality of the link is highly dependent on atmospheric factors such as rain, fog, dust and heat. In addition, to prevent the spread of the beam can birds crossing the path of light.

Today, to improve the reliability of communications in the FSO-systems use different methods, such as increasing the signal power, the use of redundant channels, the use of multibeam systems, etc. There are interesting solutions that integrate a wireless optics and microwave links.

Free-space optics technology has several applications in communications networks, where a connectivity gap exists between two or more points. FSO technology delivers cost-effective optical wireless connectivity and a faster return on investment (ROI) for enterprises and mobile carriers. With the ever-increasing demand for greater bandwidth by enterprise and mobile carrier subscribers comes a critical need for FSO-based products for a balance of throughput, distance and availability.

In Ukraine, the FSO-systems development has not yet spread. But it can greatly simplify the last mile solution.

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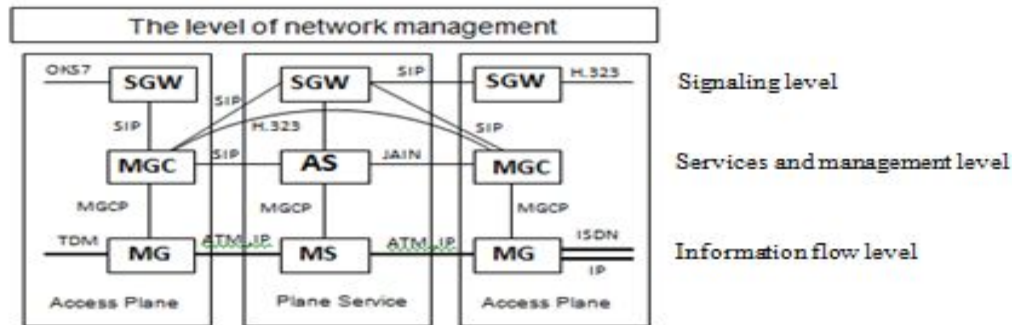
### **SOFTSWITCH – THE HEART OF NGN**

New Generation Network (NGN) is a heterogeneous multiservice network that works with the help of packet switching and provides transferring of all types of traffic and separate provision of unlimited quantity of telecommunication services with opportunity of adding, editing, distributed charging.

The architecture of NGN consists of 4 functional levels:

- Information flow level;
- Services and management level;
- Signaling level;
- Network management level;





MG (Media Gateway) is a device of interaction between packet-based transport network and access networks. Main function of MG - format conversion of flow;

MGC (Media Gateway Controller- SoftSwitch) controls the switching and management levels, ensures coordination of MG and manages connections and processing of information flows that are transferring through the transport network and access networks; SGW is a signalling gateway between the transport network and access networks;

MS is a gateway that directs the information flows to the subscriber;

AS is a server that is used to launch applications.

The above-said proves that SoftSwitch is the main device of NGN.

The typical SoftSwitch should have these features:

- should ensure consistency of signaling of the combined networks;
- should ensure switching of flows(messages);
- should provide overall management of the network (control of the network, eliminate emergency situations, etc.);
- should be able to replace the entire switching station;
- shall perform other functions for realization all management tasks, which is not finalized today.

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## **ENTERPRISE MANAGEMENT WITH ERP SYSTEMS**

An Enterprise Resource Planning system (ERP) is an integrated computer-based application used to manage internal and external resources including financial materials and human resources. Simply speaking, an ERP is a massive software architecture that supports the streaming and distribution of geographically scattered enterprise wide information across all the functional units of a business house. It provides the business management executives with a comprehensive overview of the complete business execution which in turn influences their decisions in a productive way.

Solutions for ERP play a vital role in ensuring success. With the right ERP software companies can boost corporate performance, more easily manage complex corporate structures, streamline business operations and enhance customer service in all aspects of business.

ERP is an amalgamation of three most important components: Business Management Practices, Information Technology and Specific Business Objectives.

Its purpose is to facilitate the flow of information between all business processes inside of the organization and manage the external relations.

The initials ERP originated as an extension of MRP (manufacturing resource planning). Few people would have thought of ERP in terms of rapid change. ERP systems have been around since the mid-1970s when they first ran on mainframe computers. Now ERP is still evolving, adapting to developments in technology and the demands of the market. Four important trends are shaping ERP's continuing evolution: improvements in integration and flexibility; extensions to e-business applications, a broader reach to new users and the adapting to Internet technologies.

In order to software be considered ERP it must supported by the features like flexibility, modularity, openness, widespread, finest business processes and global focus.

At the core of ERP is a well managed centralized data repository which supplies information into the fragmented applications operating on a universal platform.

The two key components of an ERP system are a common database and a modular software design. A common database is the system that allows every department of a company to store and retrieve information in real-time. A modular software design is a variety of programs that can be added on an individual basis to improve the efficiency of the business.

Implementing an ERP system in an organization is an extremely complex process. It takes a lot of systematic planning, expert consultation and well structured approach. Due to its extensive scope it may even take years to implement in a large organization. Organizations generally use ERP vendors or consulting companies to implement their customized ERP system. There are three types of professional services that are provided when implementing an ERP system, they are Consulting, Customization and Support.

Today's ERP software architecture can possibly envelop a broad range of functions and integrate them into a single unified repository. For instance, functions such as Human Resources, Supply Chain Management, Finance, Manufacturing and Logistics were all previously stand alone software applications, generally housed with their own applications, database and network, but today, they can all work under a single umbrella - the ERP architecture.

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## **IDENTIFICATION OF OBJECTS FOR AUGMENTED REALITY**

Augmented reality (AR) systems make possible for users to interact with real and computer-generated objects by displaying 3D virtual objects, registered in a user's natural environment. Registration of real world computer information on the image is critically important for further identification of the object by AR system. The main approach to the recognition of the object is appliance of visual markers. In this case we can apply color markers, barcodes, 2D-matrixes and their combinations. Every object could be attached with special code, printable by regular laser printer. This code also defines position of object in ambient space.

Firstly, image has to be binarized by extracting lightness (brightness, density) as a feature amount from the image. When a pixel is selected in an image, sensitivity is added to and/or subtracted from the value concerning the Y value of the selected pixel to set a threshold value range. When another pixel is selected, the sensitivity is added to or subtracted from the

value ,concerning the Y value of the selected pixel, and a new threshold value range is set containing the calculation result and the already setup threshold value range. The pixel with the value concerning the Y value of any pixel in the image within the threshold value range is extracted at the same brightness as the selected pixel and the extraction result is displayed.

Secondly, system processes data, and looks for connected regions of black dots, represented by binary-1 in result set. With heuristic check, system tries to select areas of picture with code. The next step is to find the code frames. For each selected region, a quad-tangle is fitted on the frame of the region using the least-square method. A position of quadrangle corners is basis for calculating parameters of transformation.

With obtained parameters, corresponding image region is projected by the system to the code rectangle matrix. The number of black and white pixels in the cell determine bit of code.

The markerless model is similar to marker based tagging but slightly more complicated as it includes calculations from GPS and compass sensors in addition to the video feed. In order to identify objects, text and image recognition also could be used. All this data is then combined and searched to determine what objects can be recognized and augmented.

There are combinations of these models, as video search and recognition software is getting increasingly mature, depending less and less on any type of marker and more and more on software processing capacity. The ability to identify most important objects with software will mark an important transition for AR.

Once identification is complete, the object to be overlaid (video or images) is positioned and oriented according to position of the glyph, or another references in the system. The final step merges the two streams together creating a seamless rendering. Since orientation and position of the glyph can be changed in real-time it is important that the objects being overlaid into the stream are rendered in three dimensions, otherwise only a single perspective would be useful. This is true regardless of the method of marking being used.

Source:

**“Augmented Reality”**: Frederic P Miller, Agnes F. Vandome, John McBrewster  
Publisher: VDM Publishing House Ltd.

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## **THE FEATURES OF BUILDING AND PROSPECTS OF DEVELOPING PARALLEL CALCULATING SYSTEMS**

Nowadays the building of parallel counting systems gets the special currency. The solving of applied problems of high complexity is impossible on uniprocessor counting systems, and the further improvement on uniprocessor counting systems is incredible because of peculiarity of technical process.

The most optimistic forecast the tact frequency soon will be near 5 GHz. At the same time reach extent of integration allows us to build parallel systems, where the number of process can be thousand processors.

Now days uniprocessor counting systems can not refer solving of applied problems in real time, that’s why to make the efficiency, of counting systems, higher is used parallel (multiprocessor) counting systems (MCS).

The developers of each MCS get the aim to make:

- Maximal arithmetical efficiency of processor
- The efficiency of operation system and comfort communication with it for programmer

- Efficiency of translation from high level languages

The classification of MCS was made by T. Jones. His classification is based on two criteria: the methods of building the memory and the way of transferring the information. The MCS has its pros and cons. The main limitation of this system is: efficiency of this system becomes lower because of changing the information between processor and memory.

In developing of computing systems there are three main problems:

- rise of efficiency

- rise of safety

- covering of semantic rupture

The ideal system is a system in which every processor has the straight connection to other processors, but this needs a lot of equipment and cables.

The most interesting variant to parallel counting is combination of virtue architecture with spread memory and a channels that is used while exchange of information between processors. One of the possible methods of building of such combination architecture is combination with commutation. This means that each processor has local memory and all processors are connected using switchboard. The switchboard can be really useful to a group of processors which have allocated memory. This configuration is like a PC which has a general memory, but there is no problems connected with throughput of the bus.

One more modern form of parallel counting is – pipelining, this also needs several processors. At the same time one multitude is processing in the first processor, the second into another etc., so we get the stream of data from one processor to another. During the all time of counting at one multitude is making  $n$  operations. At the same time on different stage of processing can be from 1 to  $n$  multitude of data.

To finish we can say that the future of counting of high complexity is on MSC, though they cost a lot and need a lot of electricity.

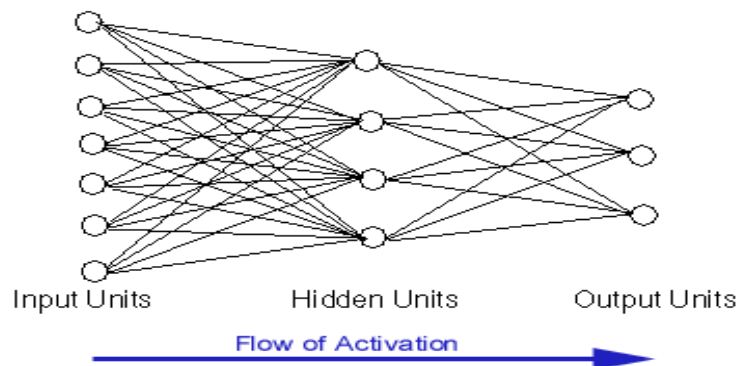
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## **FINANCIAL FORECASTING WITH NEURAL NETWORKS**

The finances are one of the most perspective and fast developing fields of human activities in which systems based on artificial intelligence (AI) are used. The artificial neural networks (ANNs) are expedient to be used as one of the useful instruments helping to make this problem easier. A neural network is, in essence, an attempt to simulate the brain. The components of an artificial neural network are an attempt to recreate the computing potential of the brain. But no one has ever claimed to simulate anything as complex as an actual brain. The human brain is estimated to have something on the order of ten to a hundred billion neurons; a typical artificial neural network is not likely to have more than 1,000 artificial neurons. Perhaps the most significant difference between artificial and biological neural nets is their organization. While many types of artificial neural nets exist, most are organized according to the same basic structure (see diagram).

Schematic Diagram of a Neural Network



Modern AI systems are hi-tech program complexes. These systems have ability to save and represent their experimental knowledge. The “knowledge” of the system is acquired via learning; the power of connections between neurons, also called synaptic connections, is used to store such knowledge. The well-taught ANN have an ability to get important data from the massive of non-strict or difficult data. They are highly resistant to errors in input data, have a high ability to generalize. It is considered that the most acceptable results for solving the problems of financial time series allows the use of the back propagation method used for perceptron ANNs, because the network learns the patterns in the sequence of values at the input. It is necessary to work with time series. The role of input data for the prediction system of prediction of currencies plays the same data, on which currency market traders focus: state of the economics, balance of payments, political, psychological factors, as well as conclusions based on the analysis of graphs of exchange rates that traders make. Desired shape prediction can be estimated expected value of the variable, plus assessment of variation of forecasting error or gap, in which the content is still possible the actual future values of the variable. However, the prognosis turns out almost always a bit misleading; forecasting errors, therefore, should be defined explicitly to facilitate the correct decision. This approach greatly reduces the risk associated with decision-making process. The introduction of an expert in the forecasting process is desirable and very important. Further, the forecast is passed to analysts, who use it making decisions.

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### **INNOVATIONS IN MAC TECHNOLOGY**

Nowadays, Mac development has become the leaders of IT technology. Steve Jobs took to the stage, most likely for the final time this year, to launch a new version of iLife and new updates to the MacBook Air line. More importantly, he spent a lot of time talking about the product line as a whole, how the Mac and iOS platforms relate to each other and what the future of the Mac might look like with the next generation of OS X, now known as Lion.

The Mac is a business, not a hobby. In year dominated by iOS devices such as the iPhone 4, iPad and even Apple TV (which, it seems, is iOS based) some wondered about Apple’s commitment to the Mac. Apple’s October event was a strong reminder that the Mac is very much a business not a hobby (a quick look at Apple’s numbers confirm that). While iOS

devices do more and more each day, there are some things that done better by a personal computer.

Apple hardware isn't converging. Apple's done a very good job at keeping things true to themselves. While Apple talks about the new MacBook Airs as the result of a hookup between and iPad and a MacBook, Apple was very clear in keeping the devices optimized for their form. For example, while multi-touch is a key Apple differentiator on both iOS and Mac OS, Apple has implemented them very differently. Touch screens make sense for iOS. That's what it was designed for. A touchscreen on a Mac would likely work as well as it does when it's used on Windows 7. It's not just that vertical touch screens tire the arm, it's that OS X and its applications are not remotely optimized for that experience. This is a key area where Apple will likely lead its competitors by keeping the hardware focused, while at the same time, driving new UI experiences.

Apple platforms aren't converging either. There's been a lot of speculation about Apple's latest app store news, an app store for the Mac OS. For some folks, this seems to be about platform convergence — an iOS layer for OS X. Granted, there's a new set of rules and requirements to be a part of the app store and apps will likely need to be modified to accommodate issues such as piracy, the installation (and de-installation) experience, and the like. Apple isn't going to close Mac OS to only use apps from the app store. There are too many scenarios where users will need that flexibility.

It is expected more hardware designs similar to the MacBook Air. Steve Jobs couldn't have been clearer. The MacBook Air has been a place where Apple starts to drive change. For example, it was the first Mac that didn't have a user-replaceable battery when it was introduced. What is more, it is expected to see more designs from Apple that lack an optical disk, that rely on flash storage and more emphasis on the concept of "open and closed" or "in use and not in use" as opposed to terms like sleep, suspend, resume or even on and off.

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## **WIRELESS MEDIA**

Wireless media carry electromagnetic signals at radio and microwave frequencies that represent the binary digits of data communications. As a networking medium, wireless is not restricted to conductors or pathways, as are copper and fiber media.

Wireless data communication technologies work well in open environments. However, certain construction materials used in buildings and structures, and the local terrain, will limit the effective coverage. In addition, wireless is susceptible to interference and can be disrupted by such common devices as household cordless phones, some types of fluorescent lights, microwave ovens, and other wireless communications.

Further, because wireless communication coverage requires no access to a physical strand of media, devices and users who are not authorized for access to the network can gain access to the transmission. Therefore, network security is a major component of wireless network administration.

The IEEE and telecommunications industry standards for wireless data communications cover both the Data Link and Physical layers. Four common data communications standards that apply to wireless media are:

Standard IEEE 802.11 - Commonly referred to as Wi-Fi, is a Wireless LAN (WLAN) technology that uses a contention or non-deterministic system with a Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) media access process.

Standard IEEE 802.15 - Wireless Personal Area Network (WPAN) standard, commonly known as "Bluetooth", uses a device pairing process to communicate over distances from 1 to 100 meters.

Standard IEEE 802.16 - Commonly known as Worldwide Interoperability for Microwave Access (WiMAX), uses a point-to-multipoint topology to provide wireless broadband access.

Global System for Mobile Communications (GSM) - Includes Physical layer specifications that enable the implementation of the Layer 2 General Packet Radio Service (GPRS) protocol to provide data transfer over mobile cellular telephony networks.

Other wireless technologies such as satellite communications provide data network connectivity for locations without another means of connection. Protocols including GPRS enable data to be transferred between earth stations and satellite links.

In each of the above examples, Physical layer specifications are applied to areas that include: data to radio signal encoding, frequency and power of transmission, signal reception and decoding requirements, and antenna design and construction.

The benefits of wireless data communications technologies are evident, especially the savings on costly premises wiring and the convenience of host mobility. However, network administrators need to develop and apply stringent security policies and processes to protect wireless LANs from unauthorized access and damage.

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## **APPLICATIONS AND PRINCIPLE OF OPERATION OF OPTICAL FIBER**

An optical fiber is a thin, flexible, transparent fiber that acts as a waveguide, or "light pipe", to transmit light between the two ends of the fiber. Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference. Fibers are used for illumination, and are wrapped in bundles so they can be used to carry images, thus allowing viewing in tight spaces. Specially designed fibers are used for a variety of other applications, including sensors and fiber lasers. Optical fiber typically consists of a transparent core surrounded by a transparent cladding material with a lower index of refraction. Joining lengths of optical fiber is more complex than joining electrical wire or cable.

Optical fiber can be used as a medium for telecommunication and networking. Each fiber can carry many independent channels, each using a different wavelength of light (wavelength-division multiplexing (WDM)). For short distance applications, such as creating a network within an office building, fiber-optic cabling can be used to save space in cable ducts. A single fiber can often carry much more data than many electrical cables, such as 4 pair Cat-5 Ethernet cabling. Fiber is immune to electrical interference; there is no cross-talk between signals in different cables and no pickup of environmental noise. Non-armored fiber cables do not conduct electricity. Wiretapping is more difficult compared to electrical connections.

Fibers have many uses in remote sensing. Optical fibers can be used as sensors to measure strain, temperature, pressure and other quantities by modifying fiber so that the

quantity to be measured modulates the intensity, phase, polarization, wavelength or transit time of light in the fiber. Extrinsic fiber optic sensors use an optical fiber cable, normally a multi-mode one, to transmit modulated light from either a non-fiber optical sensor, or an electronic sensor connected to an optical transmitter. A common use for fiber optic sensors are in advanced intrusion detection security systems.

Fibers are widely used in illumination applications. Optical fiber is used in imaging optics. In spectroscopy, optical fiber bundles are used to transmit light from a spectrometer to a substance which cannot be placed inside the spectrometer itself, in order to analyze its composition. An optical fiber doped with certain rare earth elements such as erbium can be used as the gain medium of a laser or optical amplifier. Optical fibers doped with a wavelength shifter are used to collect scintillation light in physics experiments. Optical fiber can be used to supply a low level of power (around one watt) to electronics situated in a difficult electrical environment.

An optical fiber is a cylindrical dielectric waveguide (nonconducting waveguide) that transmits light along its axis, by the process of total internal reflection. The index of refraction is a way of measuring the speed of light in a material. When light traveling in a dense medium hits a boundary at a steep angle (larger than the "critical angle" for the boundary), the light will be completely reflected. Fiber with large core diameter (greater than 10 micrometers) may be analyzed by geometrical optics. Fiber with a core diameter less than about ten times the wavelength of the propagating light cannot be modeled using geometric optics. Some special-purpose optical fiber is constructed with a non-cylindrical core and/or cladding layer, usually with an elliptical or rectangular cross-section.

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## **USING OF AUTOMATED TRAINING SYSTEMS**

Human-computer interaction is the foundation of the automated systems. It is the field focused on the interactions between human users and computer systems, including the user interface and the underlying processes which produce the interactions. The contributing disciplines include computer science, cognitive science, human factors, software engineering, management science, psychology, sociology, and anthropology. Early research and development in human-computer interaction focused on issues directly related to the user interface. Some typical issues were the properties of various input and output devices, interface learnability for new users versus efficiency and extensibility for experienced users, and the appropriate combination of interaction components such as command languages, menus, and graphical user interfaces.

Recently, the field of human-computer interaction has broadened and become more attentive to the processes and context for the user interface. The focus of research and development is now on understanding the relationships among users' goals and objectives, their personal capabilities, the social environment, and the designed artifacts with which they interact. As an applied field, human-computer interaction is also concerned with the development process used to create the interactive system and its value for the human user.

Among automated training systems the most common are human-machine systems. Human-machine systems are the complex systems that comprise both humans and machines.



Human-machine systems engineering is the analysis, modeling, and design of such systems. It is distinguished from the more general field of human factors and from the related fields of human-computer interaction, engineering psychology, and sociotechnical systems theory in three general ways. First, human-machine systems engineering focuses on large, complex, dynamic control systems that often are partially automated (such as flying an airplane, monitoring a nuclear power plant, or supervising a flexible manufacturing system). Second, human-machine systems engineers build quantitative or computational models of the human-machine interaction as tools for analysis and frameworks for design. Finally, human-machine systems engineers study human problem-solving in naturalistic settings or in high-fidelity simulation environments.

Thus, human-machine systems engineering focuses on the unique challenges associated with designing joint technological and human systems. Historically it has grown out of work on cybernetics, control engineering, information and communication theory, and engineering psychology. Subsequently, researchers who focus on cognitive human-machine systems (in which human work is primarily cognitive rather than manual) have also referred to their specialization as cognitive engineering or cognitive systems engineering.

The four major aspects of human-machine systems, in roughly historical order, are systems in which the human acts as a manual controller, systems in which the human acts as a supervisory controller, human interaction with artificial-intelligence systems, and human teams in complex systems. This general progression is related to advances in computer and automation technology.

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## **NEW API'S IN HTML 5**

HTML5 is the next major version of the HTML standard, currently under developing. Like its immediate predecessors, HTML 4.01 and XHTML 1.1, HTML5 is a standard for structuring and presenting content of the World Wide Web. The new standard incorporates features like video playback and drag-and-drop that have been previously dependent on different plugins.

New standards have some very useful for designers APIs (Application Programming Interface). The Contacts API provides access to a user's unified address book. Selectors API Level 2 specification defines methods for retrieving element nodes from the DOM by matching against a group of selectors, and for testing if a given element matches a particular selector. Programmable HTTP Caching and Serving APIs for off-line serving of requests to HTTP resources using static and dynamic responses. XMLHttpRequest provides scripted client functionality for transferring data between a client and a server. File API provides an API for representing file objects in web applications, as well as programmatically selecting them and accessing their data. HTML Microdata mechanism allows machine-readable data to be embedded in HTML documents in an easy-to-write manner, with an unambiguous parsing model. It is compatible with numerous other data formats including RDF and JSON. File API Directories and System defines an API to navigate file system hierarchies, and defines a means by which a user agent may expose sandboxed sections of a user's local file system to web applications. It builds on File API: Writer, which in turn built on File API, each adding a

different kind of functionality. Geolocation API gives scripted access to geographical location information associated with the hosting device. HTML Canvas 2D defines the context for the canvas element. HTML Media Capture form enhancement provide access to the audio, image and video capture capabilities of the device. Also used for video and audio playback in browser. It's can be used for synchronizing subtitles with video, drag-and-drop, improved page editing, work in network and without any scripts, multipurpose Internet Mail Extensions – technology that helps encode, encrypt and send files via Internet. For user that means that now you should not download different programs and application to listen of watch HQ music or video. And when I'm saying about HQ I mean real HD video and not that pseudo 720p (HD ready) and 1080p (Full HD) that now we can see on some video sites. It's became possible due to using graphical accelerating provided by video card. And because of processing all tags in browser faster loading and updating of pages is guaranteed.

Also there are many advantages for developers. Functionality of pages now became bigger. They can write code without thinking about compatibility of their plugins with different types of browsers and operating systems. New opportunities help write less code. New programming elements make constructing of pages easier. New attributes help show your creativity. But nevertheless yet it's only thoughts about smooth future technologies until HTML5 became official standard and most of browsers would handle all it functionality.

HTML5 is more a movement than it is a technology. It gives more power to the browser and mostly means more power to the browser as a programming platform. Given this focus of HTML5, it is surprisingly hard to find a good place where all the APIs will be used.

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## **WEB SERVICES AS METHOD OF ACCESS TO PARALLEL CLUSTER RESOURCES**

The computational process is the main part of almost every system. For this purpose many enterprises use clusters systems. There are some common issues, such as an absence of graphic user interface or an ability to create workflows.

Offered solution to these problems is web services. Web service is a software system designed to support an interoperable machine-to-machine interaction over a network. Two organizations for standardization which have done the most work regarding web services. They are OASIS (UDDI) and W3C (WSDL and SOAP). Three main standards of web services: Web Services Description Language (WSDL) – provides a simple and consistent syntax defining method for calling any web-service, Universal Description Discovery and Integration (UDDI) – XML-based registry for businesses worldwide to list themselves, SOAP – protocol specification to exchange structured information. Web service development tools are J2EE and C# .Net.

The essence of this method is using a standardized, loose-coupled web services that allow you to implement a service-oriented architecture. Web services provide a level of abstraction above the existing software systems such as application servers, CORBA and NET servers. HTTP protocol is used to transport SOAP messages through firewalls, and XML-based SOAP messages provide a cross-platform ability. These protocols introduce additional overhead in the data channel, but provide interoperability in a complex heterogeneous

environment. Any, already existing, program can be wrapped into a web service that allows enterprises to leverage existing development and solves many problems on the way to SOA integration.

As part of an SOA web service is published in the UDDI repository and becomes visible and accessible to other web services and enterprises. Web services can be organized into higher-level web service without knowledge about syntax of programming languages. Two main types of web service interaction models are RPC-oriented and document-oriented interactions. RPC-oriented interaction convenient for a quick exchange of data, document-oriented interaction convenient for sharing large volumes of data. ETICS and gCube are software implementations of the SOA and web services concepts.

Thus offered method of access to parallel cluster resources gives us a cross-platform and language independent abilities, graphic user interface via web-portals and, if we implement service-oriented architecture, we will have the ability “to orchestrate” web-services into workflow. This is essential for such technologies as business intelligence and business-to-business.

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## **INNOVATIONS IN UKRAINIAN CONTEMPORARY ART**

Contemporary art is not just the random exhibition of paintings or sculpture or the display of an installation. There is more to it. Contemporary art flourishes due to its attempts to call current ideas and trends in question and come into some sort of conflict with the conventional ways and ideas dominating the thinking of the general public. In this way the contemporary artist finds a way to become part of the everyday fabric of modern life.

Contemporary art is a general term that captures the spirit of creating art in the modern world. It is a label applied to working artists who are in the prime of their creative endeavors: painters, sculptors, photographers and printmakers, as well as installation and performance artists. Modern art is often distinguished by a noticeable departure from the current artistic norms. While traditionally artistic creations revolved around such topics as religion, nature and everyday life, contemporary art is often accompanied by a willingness to delve into the great political or psychological issues of the day.

Among the most recent visual arts movements such trends as Tiki Art (1996–present), Bitterism (1998–present), Stuckism (1999–present), Thinkism (September 12, 2001–present), Funism (2002–present) are worth special mention.

Contemporary art first developed in Europe and then in North America. Whereas artistic happenings in the United States and Western Europe are still the most important today, prominent artists can be found in every part of the world.

Contemporary art arrived in Ukraine as an imported concept. Young Ukrainian artists generally receive very traditional training that does not incorporate current art world trends. Most of the Ukrainian public has little experience viewing contemporary art and lacks the background knowledge needed to contextualize certain pieces. By acquainting local art practitioners and viewers with the history, international tendencies, theories and practices of contemporary art, members of the Ukrainian arts community are building up the local context for contemporary art. However the majority of Ukrainian gallery owners and art buyers have

limited expertise, so their tastes tend toward traditional media like painting and spectacular, entertaining artwork.

The effects that modern digital technology exerts on contemporary visual art deserve special discussion. Innovation very often invites skepticism about the creative abilities of an artist who uses digital software. Over the last several years, graphics software has greatly impacted the production of visual art and related industries. The invention and continued improvement of programs, such as Adobe Photoshop and Corel Painter, have revolutionized the ways that art is produced by allowing artists to do entire works on the computer. The influence of modern technology can easily be seen in the entertainment and advertising industries. The evolution of visual art is also due to 3-D programs like Maya and 3ds Max. Some advanced artists have also gone as far as to use both 2-D and 3-D graphics to create surrealistic images that instantly captivate an audience. There is the potential to create work that is not possible on a paper canvas.

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## **CLOUD COMPUTING**

Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. The underlying concept of cloud computing dates back to the 1960s, when John McCarthy opined that "computation may someday be organized as a public utility."

Generally, cloud computing customers do not own the physical infrastructure, instead avoiding capital expenditure by renting usage from a third-party provider. The cloud is associated with small and medium enterprises (SMEs) as in many cases they cannot justify or afford the large capital expenditure of traditional IT.

A cloud can be private or public. A public cloud sells services to anyone on the Internet. (Currently, Amazon Web Services is the largest public cloud provider.) A private cloud is a proprietary network or a data center that supplies hosted services to a limited number of people. When a service provider uses public cloud resources to create their private cloud, the result is called a virtual private cloud.

Cloud architecture typically involves multiple cloud components communicating with each other over application programming interfaces, usually web services. This resembles the Unix philosophy of having multiple programs each doing one thing well and working together over universal interfaces. Complexity is controlled and the resulting systems are more manageable than their monolithic counterparts. The two most significant components of cloud computing architecture are known as the front end and the back end. The front end is the part seen by the client, i.e. the computer user. The back end of the cloud computing architecture is the 'cloud' itself, comprising various computers, servers and data storage devices.

Typical cloud contains five layers: client, application, platform, infrastructure and server. A cloud client consists of computer hardware and/or computer software that relies on cloud computing for application delivery, or that is specifically designed for delivery of cloud services and that, in either case, is essentially useless without it. Cloud application services or "Software as a Service (SaaS)" deliver software as a service over the Internet, eliminating the

need to install and run the application on the customer's own computers and simplifying maintenance and support. Cloud platform services or "Platform as a Service (PaaS)" deliver a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. It facilitates deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers. Cloud infrastructure services, also known as "Infrastructure as a Service (IaaS)", delivers computer infrastructure - typically a platform virtualization environment - as a service. Rather than purchasing servers, software, data-center space or network equipment, clients instead buy those resources as a fully outsourced service. The servers layer consists of computer hardware and/or computer software products that are specifically designed for the delivery of cloud services, including multi-core processors, cloud-specific operating systems and combined offerings.

Cloud computing opens a lot of new possibilities and today many of universities, vendors and government organizations are investing in research around the topic of cloud computing.

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## **GAME THEORY IN COMPUTER SCIENCE**

Game theory is a branch of applied mathematics that is used in the social sciences, most notably in economics, as well as in computer science, biology (particularly evolutionary biology and ecology), engineering, political science, and philosophy. Game theory attempts to mathematically capture behavior in strategic situations, or games, in which an individual's success in making choices depends on the choices of others.

The games studied in game theory are well-defined mathematical objects. A game consists of a set of players, a set of moves (or strategies) available to those players, and a specification of payoffs for each combination of strategies.

There are different types of games:

- Cooperative or non-cooperative. A game is cooperative if the players are able to form binding commitments.
- Symmetric and asymmetric. A symmetric game is a game where the payoffs for playing a particular strategy depend only on the other strategies employed, not on who is playing them.
- Zero-sum and non-zero-sum. Zero-sum games are a special case of constant-sum games, in which choices by players can neither increase nor decrease the available resources. In zero-sum games the total benefit to all players in the game, for every combination of strategies, always adds to zero (more informally, a player benefits only at the equal expense of others).

Game theory has come to play an increasingly important role in logic and in computer science. Several logical theories have a basis in game semantics. In addition, computer scientists have used games to model interactive computations. Also, game theory provides a theoretical basis to the field of multi-agent systems.

Separately, game theory has played a role in online algorithms. In particular, the k-server problem, which has in the past been referred to as games with moving costs and request-answer games. Yao's principle is a game-theoretic technique for proving lower bounds on the computational complexity of randomized algorithms, and especially of online algorithms.

The field of algorithmic game theory combines computer science concepts of complexity and algorithm design with game theory and economic theory. The emergence of the internet has motivated the development of algorithms for finding equilibria in games, markets, computational auctions, peer-to-peer systems, and security and information market.

Also the game theory is used in other fields of computer science, notably:

- Maximizing profit in bidding;
- Minimum penalty when using distributional environment;
- Complexity;
- Behavior of large systems.

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### **MOBILE HARDWARE: TODAY AND TOMORROW**

Recently there has been a large number of innovations and breakthroughs in the field of mobile devices. And, first of all, such changes have a major impact on their hardware. Nowadays mobile phones and computers are just as powerful as a few years ago, and this trend is not going to stop. People want changes, so to say, better, faster, stronger.

The main feature of any hi-tech device is its computing capabilities. New applications and even platforms and operating systems appear nowadays with rapid speed. And it forces the developers to find balanced solution between high power consumption, computing capabilities and memory capacity. It's not far from dual-core mobile processors generating, for example. Of course, increasing memory is also required. Some specifications are stable – microSD card support is one of them.

One of the most important parts of any device is the part by which the device is controlled. The simplest ways involve buttons, joysticks etc, but in some cases we need more facilities. And here comes the touch screen. It's not an innovation; engineers have installed it on many business-class devices since 1998. But not long ago it got so called "second birth" with installation on middle-class phones and communicators. With the emergence of special software touch screen has become not only a way to select something but a powerful entertainment facility. The most important role plays the multi-touch screen technology that gives many opportunities to play games, surf the Internet and work with graphics. It is especially useful for that engineers designed high-resolution displays, for example 320x480, 640x460 and even 960x640. There are two types of displays: resistive and capacitive, each one has its features. What is expected in future? It can be current technologies development and, perhaps, new types of controls design, for example similar to Microsoft Kinect technology etc.

Every day convenience and mobile communications speed are growing. So, bluetooth without which it is impossible to imagine at present any mobile device has overcome a 12-year way from a profile 1.0, and has the transfer speed at a level of IRda and the address obligatory

transfer up to 3.0 with theoretical 24 Mbit per second speed and distance up to 100 meters. And you can see bluetooth 3.0 in an ordinary modern mobile device such as Samsung S5620.

Want do you want to choose: communication with your friends or downloading some fresh series of a favourite serial? It is enough to find only a point to access Wi-Fi and to be connected. Modern phones fully support Wi-fi profiles b, g, n which can provide speed up to 54 mbit per second! And it is not a problem that there is no laptop near at hand! Mobile phones fastly will replace them!

Now it is the crucial moment for the new technologies era . Every day leading developers represent to users something new. Make sure, this era is going to give us many new gadgets! And we, of course, have what to expect. One of these is the cloud computing using mobile devices, and what about mobile technologies - the binuclear processor from Qualcomm with 1,5 GHz frequency and video chip PowerVR 545 with 256 Mb memory that will close power and speed of smartphones to computers level which were made 1-2 years ago.

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## **CLOUD COMPUTING**

Cloud computing (CC) is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand.

This technology comes into focus only when you think about what IT always needs: a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends IT's existing capabilities.

The cloud is certainly a compelling alternative to running all applications within a traditional corporate data center.

Customers are both excited and nervous at the prospects of CC. They are excited by the opportunities to reduce capital costs. However, they are also very concerned about the risks of Cloud Computing if not properly secured, and the loss of direct control over systems.

There are a number of security issues that fall into two broad categories: issues faced by cloud providers (organizations providing Software-, Platform-, or Infrastructure-as-a-Service via the cloud) and security issues faced by their customers. In most cases, the provider must ensure that their infrastructure is secure and that their clients' data and applications are protected while the customer must ensure that the provider has taken the proper security measures to protect their information.

To aid both cloud customers and cloud providers, organization named Cloud Security Alliance (CSA) developed "Security Guidance for Critical Areas in Cloud Computing", initially released in April 2009, and revised in December 2009.

The purpose of this report is to give an overview of CC threats and the optimal solutions to overcome them.

I identify the following threats:

- Abuse and Nefarious Use of Cloud Computing
- Insecure Application Programming Interfaces

- Malicious Insiders
- Shared Technology Vulnerabilities
- Data Loss/Leakage
- Account, Service & Traffic Hijacking

Using the above-stated approach we could improve cloud computing security systems performance while reducing cost related to infrastructure and technical staff and also maximized efficiency and effectiveness of security applications at the enterprise level.

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## **DATA INTEGRATION IN GRID AND WEB SERVICE ARCHITECTURES**

Grid computing was originally coined as a new paradigm for solving computation-intensive problems by taking advantage of the computation power of idling computers, which can be a super computer or just a desktop computer. The Grids were then described as a well-organized virtual cluster that may span many organization boundaries.

The Semantic Web is an extension of the existing Web that aims to support the description of Web resources in formats that are machine understandable. On the Semantic Web, resources are given well defined meaning by annotating them with concepts and terminology that correlate with those used by humans. This can be achieved through the use of ontologies, providing a conceptual model that is common to all but independent of concrete representation. Therefore, to provide a framework that supports the automated mediation of syntactic structures, ontologies can be created that describe information models at a conceptual level, and used as a common vocabulary of terms for the exchange of data.

The concept of the Semantic Grid was derived from Grid Computing and the Semantic Web. In a typical semantic grid application, the network resources and services are described in a meaningful way so that the resources can be discovered, aggregated, joined up more readily and automatically.

The object of data integration is to merge information from different data sources. It has to cope with data heterogeneity originating from differences in data models, acquisition time, resolution, and quality. In the past decades a wide range of complex processes have been developed to solve specific geospatial data integration problems. One example for that statement is the progress in data integration of road networks.

However, the achieved results and progress are often neither easily transferable nor interoperable. Transferability may be restricted by processes that are tailored to specific types of datasets. Also hard-coded values of algorithm parameters complicate the application of data integration software on comparable tasks. Interoperability may be restricted due to missing interfaces and not publicly available user documentation. Another issue is the dependency on specific frameworks and proprietary software packages or libraries.

Reusable, exchangeable, and multi-purpose web services allow for building complex workflows tailored to the specific needs a data integration problem. Also the important side product data quality was introduced into the workflow. The definitions of the processes transfer, fusion, and harmonization make the classification of research outcomes and selected



methods more consistent. By creating fine-granular modules and using parallelization both massive amounts of data and complex algorithms can be handled by data integration. Grid-computing offers the collaborative utilization of resources and therefore access to computation power even for big areas or especially complex algorithms. The workflow engine developed as part of the German Spatial Data Infrastructure Grid (SDI-Grid) project simplifies the execution of legacy applications on the worker nodes of grid clusters.

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## QUANTUM COMPUTING

Nowadays computers operate on fundamental principle formalized by Alan Turing: one stable state of the machine represents one number. Even nonstandard computation models, such as the one based on DNA, share this basic principle. Yet physicists have shown that the laws describing the natural world are not the simple laws of classical mechanics – they are the subtler laws of quantum physics. These discoveries led to the idea of using quantum principles in computing.

Quantum mechanics enables the encoding of information in quantum bits (qubits). Unlike a classical bit, which can store only a single value – either 0 or 1 – a qubit can store a one, a zero, or any quantum superposition of these. Furthermore, a quantum register of 64 qubits can store  $2^{64}$  values at once. Quantum computers use such quantum mechanical properties of particles, as superposition and entanglement, which are responsible for most of the parallelism quantum systems achieve. As a consequence of such properties quantum algorithms offer a more than polynomial speedup over some classical algorithms.

There is an equivalent for Turing machine in quantum computing theory – Quantum Turing machine (or universal quantum computer). Any quantum algorithm can be expressed formally as a particular quantum Turing machine. Another model, which is used for analyzing quantum computation, is the quantum circuit. In this model a computation is a sequence of quantum gates, which are reversible transformations on an n-qubit register. These models are computationally equivalent.

Integer factorization is believed to be computationally infeasible with an ordinary computer for large integers, but Shor's quantum algorithm could efficiently solve this problem. This ability would allow a quantum computer to decrypt many of the cryptographic systems in use today.

Another example of such speedup is quantum database search, which can be solved by Grover's algorithm using quadratically fewer queries to the database than are required by classical algorithms. It is proven that an equally fast classical algorithm can not exist.

Scientists predict that 10-qubit special-purpose quantum computer will be built in few years, 10-qubit general-purpose – in 10 years, and 100 qubits in 100 years.

Quantum information theory seeks to unite some of the most influential ideas of 20th-century science: quantum mechanics, computer science, and information theory. The development of quantum information theory has only begun. Where exactly the theory will lead is hard to predict, but it seems poised to contribute to some of the most exciting ideas of the 21<sup>st</sup> century. Quantum information theory gives us an ideal framework for developing a better understanding of how nature works and what it will let us do. Such advancements in

knowledge led to new technologies and applications in the past and surely will do so again – to those we have suggested and to those yet undreamed of.

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## **INFORMATION PROTECTION IN LOCAL NETWORKS**

The computer invention and further rapid development of information technology, in the second half of 20<sup>th</sup> century, have made the problem of information protection as critical as the informatization of all society is topical nowadays. There are many reasons of computer crimes activation and connected with it financial losses. One of that reasons is the transition from traditional a "paper" storage technology and data transferring to electronic one and the low level development of information protection technology, the creation of global networks, the access expansion to information resources, the working out increase complexity of information protection frames and the number reduction of their reliability connected with it and increase brittleness.

The consequence of the development and the use of local networks is practically unlimited number of users growth of these networks and as the result, increased probability of information security threats, connected with premeditated and unintentional influence. The necessity of work with remote users and the exchange of the confidential information with them lead to relevance of rigid restrictions access of a local network information resources.

Information protection frames are a set of technical, electric, electronic, optical and other devices and adaptations, devices and technical systems, and also other real elements for the decision of various problems connected with the information protection, including leak and safety preventions of the protected information.

According FBI USA data the estimations of annual losses connected with insufficient level of local networks security are reached about \$70 billions in the USA, and on a global scale a total sum has exceeded 300\$ billions annually.

The main idea and the purpose of this article is in working out the general recommendations for establishments with the active local network, and exactly in working out the establishments security policy in the information struggle conditions; solving some problems directed at increasing level of information security in processing data system and simultaneous stability maintenance to counteraction with diversionary and technical exploration; deployment at the work some establishment's information safety documents.

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## **ADSL**

Asymmetric digital subscriber line (ADSL) uses existing twisted pair telephone lines to create access paths for high-speed data communications and transmits at speeds up to 8.1 Mbps to a subscriber. This exciting technology is in the process of overcoming the technology limits of the public telephone network by enabling the delivery of high-speed Internet access to the vast majority of subscribers' homes at a very affordable cost. This JDSU white paper

provides an overview of ADSL technology and a description of testing procedures used to qualify lines for DSL and verify service.

Delivery of ADSL services requires a single copper pair configuration of a standard voice circuit with an ADSL modem at each end of the line, creating three information channels – a high speed down-stream channel, a medium speed upstream channel, and a plain old telephone service (POTS) channel for voice. Data rates depend on several factors including the length of the copper wire, the wire gauge, presence of bridged taps, and cross-coupled interference. The line performance increases as the line length is reduced, wire gauge increases, bridge taps are eliminated and cross-coupled interference is reduced.

The modem located at the subscriber's premises is called an ADSL transceiver unit-remote (ATU-R), and the modem at the central office is called an ADSL transceiver unit-central office (ATU-C). The ATU-Cs take the form of circuit cards mounted in the digital subscriber line access multiplexer (DSLAM). A residential or business subscriber connects their PC and modem to a RJ-11 telephone outlet on the wall. The existing house wiring usually carries the ADSL signal to the NID located on the customer's premises. At the central office, a main distribution frame collects the cables from many subscribers and uses a splitter to distribute the data traffic to a DSLAM and routes the regular telephone traffic over an E1/T1 connection to the public switched telephone network (PSTN). The DSLAM mixes DSL services from different subscribers into ATM virtual circuits. Often, a DSLAM concentrator is used in cases where an ILEC or CLEC has many DSLAMs distributed over a large geographic area. The DSLAM contains ATU-Cs where ADSL signals are multiplexed onto a high-speed interface connected to an ATM (Asynchronous Transfer Mode) network. This ATM network provides access to the internet through internet service providers (ISPs). The DSL provider bundles the traffic destined for a given ISP and sends it over an E3/T3 or an STM-1/OC-3c connection. A broadband remote access server (BRAS) terminates the subscriber's IP session and directs it to the Internet backbone.

ADSL was born of the need for speed coupled with the desire for low cost dedicated remote network access. There is no doubt that ADSL will revolutionize the way we see the World Wide Web, and quite possibly witness the demise of home entertainment as we know it. There is little doubt that ADSL will be around for a long time to come, albeit under another name.

If we are to truly realise the potential of the cyberspace concept we will need to access it with as much convenience as turning on the television. With the internet influencing our lives more and more each day, it will be high speed ADSL connections that power the revolution. In the future people will view ADSL like they view cable TV.

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## **SECURITY PRINTING**

Security printing is the field of the printing industry that deals with the printing of items such as banknotes, passports, tamper-evident labels, stock certificates, postage stamps and identity cards. The main goal of security printing is to prevent forgery, tampering, or counterfeiting. Most banknotes are made of heavy paper, almost always from cotton fibres for strength and durability, in some cases linen or speciality coloured or forensic fibres are added

to give the paper added individuality and protect against counterfeiting. Some countries including Romania, Mexico, New Zealand, Israel, Singapore and Australia produce banknotes made from polymer, in order to improve wear and tear, and permit the inclusion of a small transparent window a few millimeters in size as a security feature that is very difficult to reproduce using common counterfeiting techniques.

Intaglio is a printing technique in which the image is incised into a surface. Normally, copper or zinc plates are used, and the incisions are created by etching or engraving the image, but one may also use mezzotint. In printing, the surface is covered in ink, and then rubbed vigorously with tarlatan cloth or newspaper to remove the ink from the surface, leaving it in the incisions. A damp piece of paper is placed on top, and the plate and paper are run through a printing press that, through pressure, transfers the ink to the paper. The very sharp printing obtained from the intaglio process is hard to imitate by other means. Intaglio also allows for the creation of latent images which are only visible when the document is viewed at a very shallow angle.

Microprinting, involves the use of extremely small text, and is most often used on currency and bank checks. The text is generally small enough to be indiscernible to the naked eye. Cheques, for example, use microprint as the signature line. Color changing inks are chemicals that change color when viewed at a different angle. The color of the ink does not actually change, but the angle of the light to the viewer's eye changes and thus creates the change in color. Currently there are only three types, green to purple, gold to green and green to lilac.

A hologram may be embedded either via hot-stamping foil, wherein an extremely thin layer of only a few microns of depth is bonded into the paper by means of a hot-melt adhesive (called a size coat) and heat from a metal die, or it may be directly embossed as holographic paper, or onto the laminate of a card itself.

Banknotes are typically printed with fine alignment between the printing on each side of the note. This allows the note to be examined for this feature, and provides opportunities to unambiguously align other features of the note to the printing. This is difficult to imitate accurately enough in most print shops.

With Printing Supplies Development of extensive, UV technology and scientific and technological progress in many chemical materials, including nano-materials development, the future application of ink and other supplies on the counterfeit material may have more development space, but still have two major areas to ensure that the application of flexibility and ease of detection.

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### **THREE-DIMENSIONAL DISPLAYS**

The show was and remains the main entertainment for human from time immemorial. In today's world the show instrument are different kinds of visual entertainment - TV, movies, video games and so on. The quality of the show is defined by the quality of visual effects that we perceive. This is directly related to display technologies, which are used in a different TVs and monitors. Visual displays have come a long way from a simple cathode-ray tubes to the

modern technologies for building an image. One of the most modern and most expected technologies is the technology of 3D displays.

3D displays are designed to make our experience of watching movies and video games more acute. 3D image allows us to plunge deeper into the virtual world, to make it closer to reality and to feel the atmosphere of what is happening on the screen. 3D displays are of several kinds - stereoscopic, autostereoscopic, holographic, and volumetric. They all use different ways of presenting.

Stereoscopic displays are known from the early 19Th century. They are based on the principle of constructing different images for left and right eyes, using different kinds of glasses for separation of these images. There are several types of stereoscopic technologies: anaglyph, polarization, and shutter. However, nowadays leading companies and research institutes are trying to find a way to construct three-dimensional image without any additional hardware. Some succeeded.

American company Actuality Systems has created a holographic display Perspecta Spatial 3D. It connects to the computer via Ethernet and use OpenGL technology and VRML for the formation of 3D images. The number of voxels (volumetric pixels) in the image can reach 100 million. To see the three-dimensional color image special glasses is not required. The image can be seen from any angle. IO2 Technology Company introduced a holographic display of the third generation, which can project the image up to 1024x768 resolution directly to the air mass. It is based on the fact that the projector uses airborne aerosols and water vapor in order to project an image on them. But because of this, such a device would not work in a perfectly clean and dry air. The company took care of it, firing as an attachment mobile steam generator. Scientists from the University of Southern California created their own 3D display. To create three-dimensional images this device use a rotating mirror which is covered by a special holographic diffuser, and high-speed projector. All these components allow you to create a clearly visible from any angle three-dimensional image.

This is not a complete list of amazing 3D devices. Research in constructing three-dimensional images continues to be hoped that in the near future we will be able to enjoy high-quality volumetric images, which will lead the show to a qualitatively new level. Because the show must go on!

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## **WORLD'S FASTEST SUPERCOMPUTER**

A supercomputer is a computer that is at the frontline of current processing capacity, particularly speed of calculation. Today supercomputers are design as many server computers which are connected by high performance data bus for getting maximal performance using method of parallel calculation. The measure of a computer's performance is flops - floating point operations per second. This characteristic is determined by running on the computer test program. Most popular text program is LINPACK.

A new supercomputer Tianhe-1A was unveiled at exhibition HPC 2010 in China. The supercomputer has set a new performance record of 2.507 Petaflops, as measured by the LINPACK benchmark. Tianhe-1A has a theoretical peak performance of 4.701 Petaflops.

Tianhe-1A is based on modern paradigm of heterogeneous computing, which is based on parallel work of graphics processor units (GPUs) with multi-core central processing units (CPUs). The modern paradigm enabled significant achievements in performance of the machine and decreased the size and power consumption.

The Tianhe-1A system is composed of 112 compute cabinets, 12 storage cabinets, 6 communications cabinets, and 8 I/O cabinets. Each compute cabinet is composed of four frames, with each frame containing eight blades, plus a 16-port switching board. Each blade is composed of two compute nodes, with each compute node containing two Xeon X5670 6-core CPUs and one Nvidia M2050 GPU processor. The system has 3584 total blades containing 7168 GPUs, and 14336 CPUs. 2,048 NUDT FT1000 heterogeneous processors are also installed in the system, but their computing power was not counted into the machine's official Linpack statistics as of October 2010. NVIDIA Tesla GPUs are designed specifically for high performance computing (HPC) environments and deliver transformative performance increases across a wide range of HPC fields. It based on the CUDA™ parallel computing architecture. Basic concept of the CUDA™ architecture is single instruction at multiple data (SIMD).

The Tianhe-1A is the result of two years of work by 200 scientists. The total disk storage of the systems is 2 Petabytes implemented as a Lustre clustered file system and the total memory size of the system is 262 Terabytes. In the capacity of data bus in supercomputers system usually is used a switched fabric communications link InfiniBand. Chinese scientist design proprietary high-speed interconnect called Arch that runs at 160 Gbps (Gigabits per second), twice the bandwidth of InfiniBand.

The system has weigh 155 ton and occupies the area equal 1000 square meters.

Tianhe-1A consumes only 4.04 megawatts of energy. For example, a 2.507 petaflop system built entirely with CPUs, would require more 50000 CPUs, consume more than 12 megawatts of energy and occupy two times more area. The use of GPUs in a heterogeneous computing environment makes it 3 times more power efficient. The difference in power consumption is enough to provide electricity to over 5000 homes for a year.

Tianhe-1A is designed by the National University of Defense Technology (NUDT) in China. The system is housed at National Supercomputer Center in Tianjin and is already fully operational. The Tianhe-1A supercomputer will be operated as an open access system to use for large scale scientific computations, including drug discovery, hurricane and tsunami modeling, cancer research, car design, even studying the formation of galaxies.

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**ZIGBEE TECHNOLOGY**

ZigBee (standard IEEE 802.15.4) is open standard for wireless communication systems for data collection and management. ZigBee technology enables to create self-organizing and self-healing wireless networks with automatic retransmission of messages, with the support of battery nodes and mobile nodes. ZigBee technology begins to be widely used in practice for wireless sensor networks, building automation systems, devices of automatic meter reading, alarm systems, control systems in the industry. ZigBee networks at relatively low data rates provide guaranteed packet delivery and the protection of information transmitted.

ZigBee standard provides frequency channels in the range of 868 MHz, 915 MHz and 2.4 GHz. The highest data rate and high noise immunity are achieved in the range of 2.4 GHz, which uses 16 frequency channels in increments of 5 MHz. Data transfer speed, along with service information on air is 250 kbit / s.

Feature of ZigBee is that, unlike other wireless technologies, it is intended to implement not only simple “point-to-point” and “Star”, but also complex network topologies with the “tree” and “mesh” that can maintain retransmission and find the most efficient route for transmitting data.

In the radio channel is used method of Direct Sequence Spread Spectrum (DSSS). Data are modulated by Offset quadrature phase-shift keying (O-QPSK). Data transmission mechanism is used with multiple access on the air with carrier control and the prevention of conflicts - CSMA.

ZigBee network contains two types of devices: full-function device (FFD) and reduced-functionality device (RFD). Their main difference is that FFD can be connected to any device, and RFD - only to FFD. In each piconet (PAN) should be the device - the coordinator of PAN. Its functions can be performed only by FFD. The structure of ZigBee network can contain up to 65,000 nodes. As ZigBee-devices consumes very little electricity, they can serve without recharging the batteries for many years.

ZigBee relies on the basic 802.15.4 standard to establish radio performance. As a short-range wireless standard, 802.15.4 doesn't try to compete with high-powered transmitters but instead excels in the ultra-long battery life and low transmitter power. The standard specifies transmitter output power at a nominal -3 dBm (0.5 mW), with the upper limit controlled by the regulatory agencies of the region in which the sensor is used. At -3 dBm output, single-hop ranges of 10 to more than 100 m are reasonable, depending on the environment, antenna, and operating frequency band.

Instead of pure power, ZigBee augments the basic 802.15.4 simple transmitter and protocol with an extensible, sophisticated network function that allows multi-hop and flexible routing, providing communication ranges that can exceed the basic single-hop. Indeed, depending on the data latency requirements, you can practically create networks that use dozens of hops, with cumulative ranges in the hundreds to thousands of meters. Networks can have star, cluster tree, or mesh structures; each comes with its own strengths.

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## **10 GIGABIT ETHERNET TECHNOLOGY**

From its origin more than 25 years ago, Ethernet has evolved to meet the increasing demands of packet-based networks. Due to its proven low implementation cost, reliability, and relative simplicity of installation and maintenance, Ethernet's popularity has grown to the point that nearly all traffic on the Internet originates or terminates with an Ethernet connection. Further, as the demand for ever-faster network speeds has increased, Ethernet has been adapted to handle these higher speeds, as well as the surges in volume demand that accompany them.

The 10 Gigabit Ethernet standard extends the IEEE 802.3ae\* standard protocols to a wire speed of 10 Gbps and expands the Ethernet application space to include WAN-compatible

links. The 10GbE standard provides a significant increase in bandwidth while maintaining maximum compatibility with the installed base of 802.3 standard interfaces, protects previous investment in research and development, and retains the existing principles of network operation and management. Under the OSI model, Ethernet is fundamentally a Layer 1 and 2 protocol. 10GbE retains key Ethernet architecture, including the MAC protocol, the Ethernet frame format, and the minimum and maximum frame size. Just as Gigabit Ethernet, 10 Gigabit Ethernet continues the evolution of Ethernet in speed and distance, while retaining the same Ethernet architecture used in other Ethernet specifications, except for one key ingredient. Since 10GbE is a full-duplex only technology, it does not need the CSMA/CD protocol used in other Ethernet technologies. In every other respect it matches the original Ethernet model. At the physical layer (Layer 1), an Ethernet physical layer device (PHY) connects the optical or copper media to the MAC layer through a connectivity technology. Ethernet architecture further divides the physical layer into three sublayers: Physical Medium Dependent (PMD), Physical Medium Attachment (PMA), and Physical Coding Sublayer (PCS).

Ethernet technology is already the most deployed technology for high-performance LAN environments. Similar to Gigabit Ethernet technology, the 10GbE standard supports both single-mode and multimode fiber media. With links up to 40 km, 10 Gigabit Ethernet allows companies that manage their own LAN environments the ability to strategically choose the location of their data center and server. Within data centers, switch-to-switch applications, as well as switch-to-server applications, can be deployed over a more cost-effective multi-mode fiber medium to create 10GbE backbones that support the continuous growth of bandwidth-hungry applications. Gigabit Ethernet is already being deployed as a backbone technology for dark fiber metropolitan networks.

10GbE enables ISPs and NSPs to create very high-speed links at a very low cost. Also, with the WAN PHY, allows the construction of WANs that connect geographically dispersed LANs between campuses or points of presence (POPs) over existing SONET/SDH/TDM networks.

Although 1-Gigabit Ethernet is now widely available and 10-Gigabit products are becoming more available, the IEEE and the 10-Gigabit Ethernet Alliance are working on 40-, 100-, or even 160-Gbps standards. The technologies that are adopted will depend on a number of factors, including the rate of maturation of the technologies and standards, the rate of adoption in the market, and the cost of emerging products.

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## **INNOVATION IN SCIENCE AND TECHNOLOGY**

With the invention of 3D glasses with polarizing filters we've already thought to have reached the boundaries of technology opportunities. But, let's think again because European researchers have developed technology, that can display 3D images at a monitor's full resolution, without any darkening of the ambient light, restrictions on viewing angle and with much less strain on the eyes than other 3D technologies, which based on glasses with different colored filters.

There's no any secret that current 3D technologies are not perfect. Following the release of Avatar, people have started to notice some problems with comfortable viewing the



movie. The glasses – both passive and active – became the reason of noticeable dimming of the image. Also, anyone who had saw a new 3D TV will probably have noticed that it has to be watched with the head in an vertical position. Small inclination your head can cause ghosting and some color changes. As has been reported, some people can suffer headaches and queasiness when watching 3D for an long period.

German and Swiss researchers say they have developed technology that solves these problems, which is called a EUREKA project.

A EUREKA project usually starts with a business idea. This idea has to be transformed into a concrete project description - generally split into a definition phase and an implementation phase- which highlights adequate market prospects and clear objectives. It details the involvement of sound partners from different EUREKA member states and outlines proper project management, including a realistic budget, the availability of sufficient resources and a solid cooperation agreement.

Infitec had already devised 3D technology for cinemas which called wavelength multiplexing, which is based on the principle of red and green glasses. New glasses of this company using much narrower color band wave than the old red and green glasses to improve the quality of the image, by using specific wavelengths of red, green and blue for the right eye and different ones of the same colors for the left eye. Filtering out very specific wavelengths provides different images to the left and right eyes, giving the viewer the illusion of 3D.

Finally, Infitec and Optics Balzers combined four LEDs – two green, one red and one blue – to create the color range they needed. The final result was a demonstrator 23-inch monitor called the Dualplex Display. Partners claim the quality of the image causes less strain on the eyes than other 3D technologies, because the glasses do not darken the ambient light and the screen can be viewed from all angles without any distorting the 3D images. Spectators can lie on the sofa watching the movie and the image will not change.

Though the companies' final goal is to sell the 3-D LCD screen on the consumer market, they also plan to target niche professional markets such as medical professionals. Using 3-D imaging could help surgeons doing operations, but the image quality was previously too low to interest the medical field. That could change with this technology development.

Now the partners have applied to patent the screen in Germany for selling the 3D LCD screen to home consumers. Probably soon we can have one of them at home.

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## **WiMAX**

WiMAX is a wireless digital communications system, also known as IEEE 802.16, that is intended for wireless "metropolitan area networks". WiMAX can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations. In contrast, the WiFi/802.11 wireless local area network standard is limited in most cases to only 100 - 300 feet (30 - 100m).

Technology of WiMAX allows to work in any terms, including the conditions of dense municipal building, providing high quality of connection and rate of data. WiMAX can be used for creation of broadband connections of the "last mile", development of points of off-

wire access, organization of network between the branches of companies and decision of other tasks which were limited to traditional technologies before.

Industrial alliance WiMAX Forum is created for testing, standardization, certification and marketing of WiMAX products. The Forum issues a decision of WiMAX Forum Certified.

There are numerous devices on the market that provide connectivity to a WiMAX network. These are known as the "subscriber unit" (SU).

This technology is an aggregate of off-wire and base segments. The first is described in the standard of IEEE 802.16, second determined by the specifications of WiMAX Forum. The base segment is all, that does not behave to the radio network, i.e. connection of the base stations with each other, connection with local and global networks (including with the Internet) etc. A base segment is based on IP –protocol (IETF RFC) and standards of Ethernet (IEEE 802.3-2005). The architecture of network, including the mechanisms of authentication, cryptoprotection, roaming, handover etc., described in the documents of WiMAX Forum Network.

A base model of network of WiMAX (BM) is this logical presentation of network architecture of WiMAX. A term the "logical" means in this case, that a model examines the set of the standard logical functional modules and general-purpose interfaces (points of interface of these modules). During practical realization one device can include a few functional elements or, opposite, a function can be up-diffused between different devices. BM includes three basic elements - great number of the subscriber (mobile) stations (MN), aggregate of networks of access (service network of access of ASN) and aggregate of connecting (CSN) networks. In addition, the so-called base points (R1 - R8) which an interface of the functional modules is through enter in BM. The network (networks) of ASN belongs to the provider of network of access (NAP), it is organization, to giving access to the radio network for one or a few service-provider WiMAX (NSP). In turn, a service-provider WiMAX is organization, giving IP–connection and services of WiMAX to the eventual subscribers.

The process of standardization of WiMAX falls behind from their practical realization only because this technology is extraordinarily new, however very claimed by a market.

Now maximal attention to introduction of networks of WiMAX is spared in countries with large territories and remoteness from large cities, with the large percent of rural population.

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## **APPLICATION OF MIMO TECHNOLOGY IN LTE NETWORKS**

MIMO (Multiple Input Multiple Output) - data transmission technology using multiple antennas of the transmitter and receiver to improve communication characteristics.

Previous generation cellular systems have used multiple antenna techniques such as transmit and receive diversity and beamsteering to improve the link budget. In each of these cases, a single stream of data is sent between the base station and user equipment. Release 8 of the 3GPP (3rd Generation Partnership Project) specifications, which defines the Long Term Evolution (LTE) towards 4th generation systems, includes new requirements for spatial multiplexing — also referred to as Multiple Input Multiple Output (MIMO) — wherein the base station and user equipment communicate using two or more spatial streams. The goal is to

increase both the overall capacity of a cell and the data rate that a single user can expect from the system.

MIMO technology provides the ability to use multiple ways to signal paths between transmitter and receiver in order to combat fading and re-reflections. Transmitting and receiving antennas are spaced sufficiently to achieve a weak correlation between adjacent antennas. Broadcast data stream is divided between the independent transceivers, providing communications for the same subscriber at the same frequency. In this case, compared with the conventional system data stream can be increased without expanding of bandwidth. MIMO technology is designed to increase the peak speed of traffic, average data transfer rate and bandwidth in LTE network primarily in operating conditions without line of sight, which are essential for supporting future broadband data service over wireless links.

Spatial multiplexing allows to transmit different streams of data simultaneously on the same downlink resource block. These data streams can belong to one single user (single user MIMO / SU-MIMO) or to different users (multi user MIMO / MU-MIMO). While SU-MIMO increases the data rate of one user, MU-MIMO allows to increase the overall capacity. The key advantage of MU-MIMO over SU-MIMO is that the cell capacity increase can be had without the increased cost and battery drain of two UE transmitters.

To implement speeds up to 326.4 Mbps LTE will use MIMO technology in the antenna configuration 4x4. In 2x2 configuration, limiting downlink speed can reach 172.8 Mbps (in each frequency band 20 MHz). Peak uplink speed may reach 86.4 Mbps on each strip at 20 MHz. The modulation schemes on the uplink and downlink differ. The uplink will be Single-Carrier Frequency Division Multiple Access (SC-DFMA), a OFDM variant, and the downlink is OFDMA.

Advantages of using MIMO:

1. Improving the function of downlink, which is manifested in the form of more stable and more reliable data transmission under conditions of strong scattering of radio waves.
2. Increasing the capacity of MIMO by allowing using modulation schemes with higher levels of simultaneous transmission of multiple independent streams.
3. Increasing the stability of working characteristics of MIMO systems, especially with movements of the subscriber.

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## **WIRELESS TECHNOLOGY**

In telecommunications, *wireless communication* is the transfer of information without the use of wires. The distances involved may be short (a few meters as in television remote control) or long (thousands or millions of kilometers for radio communications). The term is often shortened to "wireless". It encompasses various types of fixed, mobile, and portable two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. Other examples of *wireless technology* include GPS units, garage door openers and or garage doors, wireless computer mice, keyboards and headsets, satellite television and cordless telephones.

*Wireless operations* permits services, such as long range communications, that are impossible or impractical to implement with the use of wires. The term is commonly used in

the telecommunications industry to refer to telecommunications systems (e.g. radio transmitters and receivers, remote controls, computer networks, network terminals, etc.) which use some form of energy (e.g. radio frequency (RF), infrared light, laser light, visible light, acoustic energy, etc.) to transfer information without the use of wires. Information is transferred in this manner over both short and long distances.

Wireless networking (i.e. the various types of unlicensed 2.4 GHz WiFi devices) is used to meet many needs. Perhaps the most common use is to connect laptop users who travel from location to location. Another common use is for mobile networks that connect via satellite. A wireless transmission method is a logical choice to network a LAN segment that must frequently change locations. The following situations justify the use of wireless technology:

- To span a distance beyond the capabilities of typical cabling,
- To provide a backup communications link in case of normal network failure,
- To link portable or temporary workstations,
- To overcome situations where normal cabling is difficult or financially impractical, or
- To remotely connect mobile users or networks.

*Wireless communication* can be via:

- radio frequency communication,
- microwave communication, for example long-range line-of-sight via highly directional antennas, or short-range communication, or
- infrared (IR) short-range communication, for example from remote controls or via Infrared Data Association (IrDA).

Applications may involve point-to-point communication, point-to-multipoint communication, broadcasting, cellular networks and other wireless networks.

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**THE POWER OF THE PORTABLE CALCULATIONS**

No one should be surprised that the big action in the CPU market this year will be in the mobile and low-power processor segments. Rapid growth in the power-saving all-in-one and small-form-factor desktop PC markets, continued strong demand for portable computers, and new usage models (digital photo and video editing, casual gaming, watching high-definition movies and so on) will all ignite demand for powerful new processors that consume less energy than previous generations did.

Intel should notch the most mobile design wins this year, thanks to its ultra-low-power Atom processor and its Arrandale series processors, the latter of which integrate both a dual-core CPU and GPU in the same package. AMD's graphics division, on the other hand, should earn a lot of business in the desktop-replacement notebook market, because it's currently the only company that has a mobile graphics processor capable of supporting Microsoft's DirectX . In the handheld and smartbook market, ARM Holdings' Cortex-A8/A9 processors should gain significant traction.

AMD will continue to trail Intel on the mobile CPU front in 2010; in fact, the company has just two new mobile processors on its public road map for this year. AMD's first

quadcore mobile CPU, code-named Champlain, will have 2MB of cache (512MB for each core) and support for DDR3 memory. AMD also plans to offer Champlain in dual-core trim.

AMD's second new mobile offering, code-named Geneva, will be a dual-core processor with 2MB of cache and DDR3 memory support. Geneva will form the basis of AMD's Nile platform for ultrathin notebooks and will feature DirectX 10.1 integrated graphics, with optional support for a DirectX 11 discrete GPU. AMD hasn't released any additional details about Champlain and Geneva since briefing analysts on the new chips in November.

Intel's 2010 mobile CPU offerings include the products announced immediately prior to CES: five new Core i7 chips, four new Core i5 models and two new Core i3 offerings. Intel will continue to use its older 45nm manufacturing process to build its high-end Core i7 mobile quadcore CPUs, but the new Core i3 and Core i5 dual-core chips (previously code-named Arrandale) will all use the 32nm Westmere process. These chips will have a graphics processor integrated in the same package as the CPU.

What's more, the new mobile processors can dynamically trade thermal budgets between the CPU core and the graphics core (a feature not supported on their desktop counterparts). If the computer is running a CPU-intensive application, for example, the processor will dial back the GPU to let the CPU run faster and hotter; likewise, if the computer is running a graphics-intensive application, the processor will dial back the CPU to give the GPU more thermal headroom.

Intel's new mobile processors will use the same graphics core as their desktop counterparts, so they'll offer all the same features, including support for DVI, dual simultaneous HDMI 1.3a, and DisplayPort interfaces, Blu-ray video decoding, along with Dolby TrueHD and DTS-HD Master Audio soundtracks.

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## **MICROSOFT SURFACE**

**What is Microsoft Surface?** Microsoft Surface is a revolutionary multi-touch computer that responds to natural hand gestures and real-world objects, helping people interact with digital content in a simple and intuitive way. With a large, horizontal user interface, Surface offers a unique gathering place where multiple users can collaboratively and simultaneously interact with data and each other.

**For Users:** Microsoft Surface represents a fundamental change in the way we interact with digital content. Leave the mouse and keyboard behind. Surface lets you grab digital content with your hands and move information with simple gestures and touches. Surface also sees and interacts with objects placed on the screen, allowing you to move information between devices like mobile phones or cameras. The result is a fun, social and exciting computing experience like you've never had before.

**For Businesses:** Microsoft Surface provides tremendous potential for businesses to improve communication, and be more efficient in how they deliver information and services to their customers. The intuitive and approachable interface is easy to learn and the familiar software platform makes it easy to manage, too. The multi-touch and multi-user capabilities create an incredibly collaborative experience, where sharing and exploring information is easier than ever.

### **What are the key capabilities of Microsoft Surface?**

Microsoft Surface has four key capabilities that make it such a unique experience:

- Direct interaction. Users can grab digital information with their hands and interact with content on-screen by touch and gesture – without using a mouse or keyboard.
- Multi-user experience. The large, horizontal, 30 inch display makes it easy for several people to gather and interact together with Microsoft Surface - providing a collaborative, face-to-face computing experience.
- Multi-touch. Microsoft Surface responds to many points of contact simultaneously - not just from one finger, as with a typical touch screen, but from dozens of contact points at once.
- Object recognition. Users can place physical objects on the screen to trigger different types of digital responses – providing for a multitude of applications and the transfer of digital content to mobile devices.

**How does Microsoft Surface work?** Microsoft Surface uses cameras and image recognition in the infrared spectrum to recognize different types of objects such as fingers, tagged items and shapes. This input is then processed by the computer and the resulting interaction is displayed using rear projection. The user can manipulate content and interact with the computer using natural touch and hand gestures, instead of a typical mouse and keyboard.

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### **STEREO VISION**

How can people recognise that one object is closer than the other? For this purpose we have two eyes, so we can use stereo vision. These two particular sources of virtual information give us the opportunity to perceive forms, sizes and distances. Then images process in our brain in real time and we see that one object is closer. Our brain receives two similar images from the eyes, but they have still different angles of vision (in 3D it's called camera position) and these two pictures are accepted by us as one three-dimensional image.

But on monitors, TVs and almost all other devices that display information we see just a flat picture without depth. Stereo vision is important because the main purpose of all tridimensional graphics (games and professional programs) is to make us believe in three-dimensionality of the picture and 3D space in it. Nowadays, all known formats and standards of stereo vision make active progress. Because, all possibilities of 2D standards have been depleted (resolution can't be more than Full HD) and a simple user does not want to use the imagery that he already has, he wants something more.

Producers have also started the advancement of 3D-format in films. We can find almost all new movies in 3D-format. Remember James Cameron with his movie "Avatar" that became a catalyst for stereo vision development and the most successful film is history. Developers of household appliances also show their innovations in 3D-TV, Blue-ray-3D-players and home theaters.

There are a few methods of stereo vision: virtual reality helm, technologies that use active and passive stereo glasses. However, every technology has its advantages and disadvantages. Firstly, virtual reality helm has clear separation of images for different eyes,

because screens do not depend on each other and every eye sees only its own picture. Though, the low quality screens and a high price are the biggest minuses of this technology.

Secondly, bottom-of-the-line is anaglyphic method. In this case a user must use special glasses with colour heliofilters. In most situations the colour of heliofilter for the left eye is red and for the right one is blue. Advantage of this method is low price of all equipment that is needed, but the disadvantage is low quality of colour rendition. After long period of using these glasses people can feel discomfort with colour rendition in real world.

Another method of stereo vision uses polarization glasses. One screen shows two images for both eyes simultaneously but with different polarisation. When a person watches the movie in these glasses every eye gets its own picture. This technology does not have a problem with low quality of colour rendition but the equipment that is needed must be more complicated and expensive.

And the last one is a technology of shutter glasses and high quality monitors with 120Hz refresh rate. This technology gives the best illusion of 3D image. Shutter glasses are more expensive than polarisation and the technology is not perfect. However, the future of stereo vision stands behind this method.

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## **DIE TECHNOLOGIE DER VIRTUELLEN INSTRUMENTE (LABVIEW)**

LabVIEW (англ. Laboratory Virtual Instrumentation Engineering Workbench) - ist eine Entwicklungsumgebung und eine Plattform für laufende Programme, die in der grafischen Programmiersprache «G» Unternehmen "National Instruments (USA)" geschaffen ist. LabVIEW ist bei der Datenerhebung und-Verarbeitung sowie für die Verwaltung technischer Objekte und der technologischen Prozesse benutzt. LabVIEW ideologisch ist sehr nah an der SCADA-Systeme, zu aber im Gegensatz zu ihnen stärker auf Problemlösung, anstatt in der Steuerung wie in ASNI.

Grafische Programmiersprache «G», in LabVIEW eingesetzt, ist auf die Architektur von Datenströmen basiert. Die Reihenfolge von Operatoren in solchen Sprachen ist nicht durch ihre Reihenfolge bestimmt (wie in imperativen Programmiersprachen), und die Verfügbarkeit von Daten über den Eingängen dieser Operatoren. Die nicht durch die Daten verbundenen Betreiber werden parallel in beliebiger Reihenfolge aufgeführt.

LabVIEW-Programm ist die virtuelle Instrumente (Englisch Virtual Instrument) genannt und besteht aus zwei Teilen:

- ein Blockdiagramm, das die Logik des virtuellen Instruments beschreibt;
- Frontplatte, die die externe Schnittstelle des virtuellen Instruments beschreibt.

Virtuelle Geräte können als Komponenten in anderer virtueller Instrumente genutzt werden.

Die Frontplatte enthält ein virtuelles Gerät I / O: Tasten, Schalter, LEDs, Vernier, Maßstab, Plakate, etc. Sie werden von Menschen verwendet, um virtuelle Instrumente sowie andere virtuelle Geräte zum Austausch von Daten zu steuern.

Das Blockdiagramm enthält die funktionalen Einheiten, die die Quellen, Empfänger und Datenverarbeitungsanlagen sind. Funktionale Einheiten und Terminals sind in einem einzigen Schaltkreis durch Linien der Kommunikation kombiniert.

**Vorzüge LabVIEW:**

- Eine voll funktionsfähige Programmiersprache
- Intuitive verständliche Verlauf der grafischer Programmierung
- Schulung und technische Unterstützung der Weltklasse
- Kompatibilität mit Betriebssystemen Windows2000/NT/XP, Mac OS X, Linux und Solaris

Die in LabVIEW geschriebenen werden weltweit in verschiedenen Branchen angewandt:

- Autoindustrie
- Telekommunikation
- Luft

Aufgrund seiner Flexibilität und Skalierbarkeit, kann LabVIEW in allen Phasen des Prozesses verwendet werden: von der Modellierung und Prototyping von Produkten bis Großproduktion Tests.

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## **INTRODUCTION TO CRYPTOGRAPHY**

Cryptography - the study of techniques related to all aspects of data security. Some aspects of data security: confidentiality, data integrity, entity authentication, data origin authentication. Cryptanalysis is the study of techniques to defeat cryptographic techniques. Understanding data encryption has experienced a new urgency among IT professionals, on the basis of several recent developments. First, there has been an explosive growth in the exchange of electronic information. In classical cryptography, there is a message, a sender, and a receiver. It is assumed that any communication between sender and receiver may be easily read by a hostile person, or attacker. The usual objective of cryptography is to encode the sender's message in such a way that the attacker cannot understand it. In more complex cryptographic models, methods are used to authenticate the identity of the sender, to prevent the attacker from altering the message unbeknownst to the receiver and so on. The initial message prepared by the sender is written as plaintext, which the sender converts into ciphertext before the message is transmitted. The process of converting plaintext into ciphertext is called encryption. The encryption process requires an encryption algorithm and a key. the process of recovering plaintext from ciphertext is called decryption.

In classical cryptography, the key is exchanged secretly between sender and receiver over secured communication, or through a trusted intermediary. The accepted view among professional cryptographers is that the encryption algorithm should be published, whereas the key must be kept secret. The purpose of publishing the encryption algorithm is to place it before the academic cryptography community, which will discover its flaws. Better that the flaws in the encryption algorithm be first discovered in academia than when the message is secretly decoded by the attacker.



In this paper, besides the introduction to cryptography, a new cryptotechnique is proposed based on the authors work.

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## **EXT JS EASES WEB APPLICATION DEVELOPMENT**

Ext JS is a cross-browser JavaScript library for building rich Internet applications. Ext JS makes it very easy to create GUIs that run in the browser using JavaScript.

JavaScript is certainly a powerful language, and HTML certainly has a great deal of elements that can be used for some powerful GUIs. But the two—JavaScript and HTML—don't exactly play well together. If you want to create a complex GUI in JavaScript, you're up against a formidable task. The recently released Ext JS makes it incredibly easy to create GUIs that run in the browser using JavaScript. Ext JS can do a complex desktop with draggable windows running right inside your browser or GUI that's built like a typical e-mail program, with sliding panels and trees. The idea is that you piece together your GUI using JavaScript objects that describe in detail what you want. The GUI library in Ext JS is very rich. You can create tabbed panels, data grids, forms with buttons and other elements rendered to match a particular theme, and you can use various layout mechanisms for organizing your controls, much like what you have with languages such as Java. But Ext JS goes beyond just the GUI. It includes several classes for performing AJAX queries on the server and the results can be parsed using various encodings, such as XML. Ext JS now includes server-side code for many different languages and platforms—including PHP, Java, ASP.NET including MVC and Perl - that will help save you time and effort in building your server code. These libraries fit together carefully with the client-side classes, making for easy generation and transfer of data. Ext JS developers have also gone to great lengths to make sure that the Web applications you write with the product will work in all major browsers, including Firefox, IE, Safari and Opera. Ext JS also includes support for Adobe AIR, and there's a version that's integrated into Google Web Toolkit.

The downsides of Ext JS that your final Web page ends up with a lot of DOM elements. Many of the single Ext JS elements are constructed of numerous DIV and TABLE tags piled inside of each other. Ext JS can be difficult if you want to create some really complex GUIs, for example, when trying to create a dialog box that has numerous controls and doesn't follow a set "field label – field" layout. Ext JS' documentation also leaves a bit to be desired. There's an awful lot of it, but it's really not complete. The examples often use custom classes buried inside example code that isn't immediately apparent, and many of the API entries have minimal explanation of what the various configuration options do.

Earlier versions of the product were apparently available under the LGPL license, basically allowing you to use Ext JS in commercial products without payment to Ext, the company that owns the product. But that model has changed, much to the chagrin of some customers. Now the product includes a dual licensing model: You can license the product under the GPL (not the LGPL) or purchase a commercial license.

Ext is a JavaScript library for building interactive web applications using techniques such as Ajax, DHTML and DOM scripting.

“Telecard-Pribor” is one of the leading companies in Ukraine. The basic line of activity of “Telecards-Pribor” is working out and batch production of plastic cards (payphone cards), single-phase counters, electronic counters, electric convectors, fan heaters and access monitoring systems. It trains personnel for complex maintenance of equipment and designs equipment, hardware and software for the army special forces.

The “Telecard-Pribor” Ltd. has modern, highly productive equipment from Germany, Japan, France, Holland and the USA.

For production technologies there have been used metal and plastic machining, aluminium and plastic casting, printed circuit-boards electric assembly, electronic equipment assembly and regulation; automatic testing and electronic equipment checking, automated assembly of electronic cards, base casting for plastic cards.

In this paper we'll consider a portable VHF tactical radio designed by “Telecard-Pribor”. It provides radio simplex communication within tactical control link (company or battalion). R-005 operates in simplex and semi - simplex modes, receiving and transmitting digital data at a rate of 1,2; 2,4; 4,8; 9,6 and 16 kbps and shot messages as large as 100Kb. R-005 replaced the portable radio R-159. All components are made from aluminium alloy. On the front panel the following slots are established:

- 1) Antenna connector;
- 2) Highly frequency connector for the exterior power connection;
- 3) The earthing terminal;
- 4) The slot for external control connection.

The connective box is used to provide R-005 compatibility with analogue telephone devices such as TD-57 and TD-01.

Software is a part of a delivery set. It is allocated on the CD-R. The program does not demand installation on your computer. It is copied from CD-R on a hard disk of the computer.

The program of receiving and transmitting data provides data exchange between PC and radio. For the effective operation of R-005 Windows 98, Windows XP, Windows Seven, Windows Vista and other OS are required.

There are 2 modes for transmitting data:

- 1) Data transfer in a flow with or without a message.
- 2) Data transfer in a packet. This mode provides transmission of a file in blocks. On the delivery of each block the receiving end sends acknowledgement packet. At successful transmission of one block the following is transferred immediately. If the block has been transferred with errors, it is transferred once again.

This century has seen the rapid development of IT which has become an indispensable part of every sphere of our life. And Ukrainian army today needs modern hardware and software to face new challenges. In my opinion The VHF Radio R-005 will be widely used in the Armed Forces in the nearest future. It will support effective accomplishment of military missions in modern conditions where communication plays a vital role.

## **FIRE WIRE – HIGH-SPEED INTERFACE**

Fire Wire, IEEE-1394 and i.Link - three titles of the same high-speed serial communication between peripheral devices and computer, which is suitable for constructing branched LANs.

IEEE-1394 appeared on a computer's standards for a long time ago, back in 1995, but for a long time could not find a widespread and worthy application. This is explained by several factors. Initially, Microsoft did not believe in the future of the bus, so the most popular operating system - Windows - did not have interface support, which appeared only in Windows 98. Therefore, this interface was actually undivided advantage of users' computers from Apple. By popularity FireWire inferior USB, but in many ways surpasses even the USB 2.0. Reasons for greater popularity of the latter is obvious: all modern computers have built-in USB-port, whereas the use of FireWire in most cases still need to additionally buy and install a special controller. In addition, devices with this interface are more expensive than just a USB-enabled.

There are two interface specification - IEEE-1394a and IEEE-1394b (respectively, FireWire 400 and FireWire 800), differing in bandwidth and a maximum length of cable between devices. Wide bandwidth gives high speed data transfer - 100, 200 and 400 Mbps for IEEE-1394a to 800 Mbps for IEEE-1394b. (For comparison, the throughput of USB 1.1 is equal to 10-12 Mbps, USB 2.0 - 360-480 Mbps). It provides high-speed exchange of large data sets, such as, for example, streaming video or audio. The interface is also suitable for hard drives. It is not surprising, since the interface was designed primarily for high-speed access to storage devices and only later found application in the periphery. There are mobile hard drives based on FireWire, as well as external box for hard disk drives IDE/ATAPI adapter for IEEE-1394. When connecting devices are automatically detected by the system and can start working on - like Plug & Play.

There are two types of wire Fire wire: 4 - and 6-pin. 6-pin cable consists of two twisted pairs and two shielded power wires. The connectors for these wires have also six contacts. This cable is used when the implied power the device from the computer. Power supply cables are designed for currents up to 1.5 A and voltages from 8 to 40 V. If there is no need to feed power from the past are designed with slots for 4-pin cable.

IEEE 1394 devices are organized in three-level scheme - Transaction, Link and Physical, corresponding to the three lower levels of the model OSI. Transaction Layer - routing streams of data to support asynchronous protocol write- read. Link Layer - creates data packets and ensures their delivery. Physical Layer - convert digital data into analog for transmission and vice versa, the control signal on the bus, control access to the bus.

The connection between the PCI bus and Transaction Layer implements Bus Manager. He appoints the kind of devices on the bus, the number and types of logical channels, detects errors.

Data is transmitted frames length 125 microseconds. In the picture posted time slots for the channels. Can be both synchronous and asynchronous modes of operation. Each channel can occupy one or more time slots. For data transmission device transmitter requested synchronous channel the required bandwidth. If the transmitted frame is the desired number of time slots for the channel, receives an affirmative response and the channel is available.

## **UNIX VS. MICROSOFT WINDOWS: HOW SYSTEM DESIGNS REFLECT SECURITY PHILOSOPHY. THE IMPORTANCE OF PRIVILEGE SEPARATION**

One of the key differences between the Unix approach to system security and the MS Windows approach is that significant security characteristics of Unix systems are a consequence of good architectural design. Many of these same characteristics, when there is any attempt at all to incorporate them into MS Windows, are implemented as features on top of the OS instead of designed into the system architecture.

For instance, privilege separation in Microsoft Windows has long been a problem for Windows security. Some privilege separation does exist in MS Windows at the architectural level, but it is only a half-hearted implementation, dependent upon user-level features behaving well and being used as intended.

Modularity within the system is another example of architectural security in Unix, but lacking in MS Windows. There are applications that tie into every major part of the MS Windows system in such a promiscuous fashion that something as apparently trivial as a browser exploit can actually reach into kernel space, and from there affect the entire system. The same kind of close coupling between parts of the system does not exist in the base system of Unix.

Some might complain that all the information you want to protect on your system is stored where your user account can access it, so that privilege separation does not really help security much. These people fail to grasp the full extent of what security benefits you gain from separation of privileges, however. Privilege separation does more than prevent infections and intrusions from gaining access to root privileges.

Malware that makes its way to the system via the network is hindered by the fact that server processes typically run under specialized user accounts on Unix systems. This means that getting in through some network port usually gets the intruder no further than the affected service. This is even true of many services that are started from a normal user account, because those services are typically configured to switch user account “owners” when they start to take advantage of the benefits of privilege separation.

Many tools of malicious security hackers require administrative access to work effectively for them. Keyloggers are one of the major bogeymen of MS Windows security, but they require access to administrator-level components of the system to operate effectively on Unix. This means that a keylogger inserted into the system via some unprivileged user account does not have the access it needs to do its job.

Other security threats, such as rootkits, trojan horses, and botnet clients, also require root access on a Unix system to work. On MS Windows, the lack of rigorous privilege separation short-circuits this defense against malware.

## **DEVICE THAT ALLOWS USING THE ARM AS A TOUCHSCREEN**

Latest invention called Skinput, which represents a skin-based interface that makes it possible for a person to use his or her palm as a touchscreen. The system is a marriage of two technologies: the ability to detect the ultralow-frequency sound produced by tapping the skin with a finger, and the microchip-sized "pico" projectors now found in some cellphones.

The Skinput can be used to play games, control various devices, make phone calls and surf the Internet. The invention features a keyboard, menu and a number of other. The graphics are generated by a pico projector.

They have identified various locations on the forearm and hand that produce characteristic acoustic patterns when tapped. The acoustic detector in the armband contains five piezoelectric cantilevers, each weighted to respond to certain bands of sound frequencies. Different combinations of the sensors are activated to differing degrees depending on where the arm is tapped.

When the user touches a certain point on his or her palm, the acoustic detector in the armband identifies the part that was activated and performs the respective action. Scientists explain that the differences in bone density, size and mass, along with filtering effects from a person's soft tissues and joints, imply that various locations on the user's skin have different acoustic features. Their software matches sound frequencies to specific skin locations, allowing the system to determine which "skin button" the user pressed.. It is worth mentioning that the acoustic detector used in this invention is able to identify five skin locations, registering an accuracy of about 95.5 percent.

"Skinput works very well for a series of gestures, even when the body is in motion," the researchers say, with subjects able to deftly scroll through menus whether they moved up and down or flicked across their arm.

The researchers have shown that Skinput can allow users to simply tap their skin in order to control audio devices, play games, make phone calls, and navigate hierarchical browsing systems.

As the researchers explain, the motivation for Skinput comes from the increasingly small interactive spaces on today's pocket-sized mobile devices. They note that the human body is an appealing input device "not only because we have roughly two square meters of external surface area, but also because much of it is easily accessible by our hands (e.g., arms, upper legs, torso)."

## **DIE COMPUTER-TO-PLATE-TECHNOLOGIE**

Der Begriff Computer to Plate (CtP) oder deutsch Digitale Druckplattenbelichtung (DDB) bezeichnet ein Verfahren in der Druckvorstufe, bei dem die Druckplatten vom PC aus direkt im Plattenbelichter bebildert werden. CtP bezeichnet außerdem die zur Zeit (2009) noch in der Frühentwicklung befindliche Belichtungstechnik Computer to Press, bei der die

Druckseiteninhalte direkt an die Druckzylinder gesendet werden, so dass sogar jeglicher Druckplattenwechsel in der Druckmaschine entfällt.

Im Gegensatz zur indirekten Bebilderung über das konventionelle Filmbelichtungsverfahren Computer to Film (CtF) erspart CtP erhebliche Montage- und Materialkosten. Gleichzeitig lassen sich mit direkt bebilderten Druckplatten hochwertigere Druckergebnisse erzeugen. Ein weiterer Vorteil dieses Verfahrens ist eine Reduzierung von diversen mechanischen Einflüssen auf die Druckplatte, wie zum Beispiel Fehlbelichtungen, Staub und Kratzer. Diverse Plattenbelichter verfügen über ein sogenanntes Online-Entwicklungsverfahren, das eine Entwicklung der Druckplatte in einer externen Entwicklungsmaschine überflüssig macht. Somit werden weitere qualitätsmindernde Faktoren eingeschränkt. Als Datenformat wird im CTP-Verfahren heute zumeist TIFF-G4 verwendet.

CtP ist ein übergeordneter Begriff für zahlreiche unterschiedliche Bebilderungsverfahren von Offsetdruck-Platten. Die CtP-Rekorder teilen sich entsprechend ihrer Bauweise in Innentrommel-, Außentrommel- oder Flachbett-Belichter und hinsichtlich der verwendeten Lichtquellen, in violette und thermische Laser- und UV-Lichtquellen, sowie der Plattenbeschichtung und der Entwicklung der belichteten Platte. Die meisten Laserlichtquellen liegen im Bereich des sichtbaren Lichts. Das bedeutet für das jeweilige Plattenmaterial, dass dessen Verarbeitung unter komplementärem Licht geschieht. Am angenehmsten dürfte die Verarbeitung von Thermoplatten bei Tageslicht sein, sowie die Erstellung von Violett-Platten unter gelbem Sicherheitslicht.

Das Licht einer UV-Lampe wird über eine Optik auf die Druckplatte gelenkt und projiziert bei jedem Belichtungsvorgang gerasterte Teilbilder auf die flach liegende Platte. Der Belichtungskopf wird horizontal und vertikal über die Platte geführt und setzt die Teilbilder zu einem Gesamtbild zusammen. Dieses System bietet die Möglichkeit, mit der neuen Technologie konventionelle preiswerte Offsetplatten zu belichten.

Erste CtP-Lösungen wurden Ende der 80er Jahre vorgestellt und standen spätestens 1990 im Mittelpunkt des Interesses. Bereits in den ersten Jahren des letzten Jahrzehnts sorgte die Investition in einem CtP-System für eine bessere Positionierung am Markt und ermöglichte eine Differenzierung von den Wettbewerbern. Allerdings hatten die ersten Anwender noch mit einer Reihe von Unwägbarkeiten zu kämpfen. Neu waren ja nicht nur Geräte- und Belichtungstechniken, sondern vor allem die CtP-Druckplatten mit ihrer jeweils erforderlichen Chemie und den passenden Entwicklungsgeräten.

Doch diese Anfangsschwierigkeiten sind heute endgültig Vergangenheit. CtP ist mittlerweile in allen Industrieländern etabliert und kommt breit zum Einsatz. Early adopters“, die ersten Anwender, sind längst auf Workflow- und Ausgabe- Systeme der neuesten Generation umgestiegen.

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## **SUPERCAPACITOR**

Nowadays, electronics is developing very rapidly, so it needs new materials and new technologies. Every new component is being made lighter, cheaper and with best electrical characteristic. One of the components, which can take considerable high positions in electronics, is supercapacitor.

Supercapacitors also called ultracapacitors and electric double layer capacitors (EDLC) are capacitors with capacitance values greater than any other capacitor type available today. Capacitance values reaching up to 400 Farads in a single standard case size are available. Larger double-layer capacitors have capacities up to 5,000 farads.

What makes supercapacitors different from other capacitor types are the electrodes used in these capacitors. Supercapacitors are based on a carbon (nanotube) technology. The carbon technology used in these capacitors creates a very large surface area with an extremely small separation distance. Capacitors consist of 2 metal electrodes separated by a dielectric material. The dielectric not only separates the electrodes but also has electrical properties that affect the performance of a capacitor. Supercapacitors do not have a traditional dielectric material like ceramic, polymer films or aluminum oxide to separate the electrodes but instead have a physical barrier made from activated carbon that when an electrical charge is applied to the material a double electric field is generated which acts like a dielectric. The thickness of the electric double layer is as thin as a molecule.

The advantages of supercapacitors are that they doesn't subject to the wear and aging; have low impedance; rapid charging; voltage-limiting circuit compensates for selfdischarge and lower energy density is compensated by a very high cycle count; have good reversibility; has high output power; no full-charge detection is needed; very high rates of charge and discharge.

The disadvantages are that they unable to use the full energy spectrum; low energy density; cells have low voltages, so serial connections are needed to obtain higher voltages; voltage balancing is required if more than three capacitors are connected in series and the self-discharge is considerably higher than that of an electrochemical battery; linear discharge voltage prevents use of the full energy spectrum.

Capacitors are extensively used as power back-up for memory functions in a wide range of consumer products such as mobile phones, laptops and radio tuners. Used in pulsed applications to share the load and for providing peak power assistance to reduce the duty cycle on the battery to prolong battery life in products or devices using mechanical actuators such as digital cameras. Also used for energy storage for solar panels, and motor starters. Supercapacitors are also used to provide fast acting short term power back up for UPS applications. By combining a capacitor with a battery-based uninterruptible power supply system, the life of the batteries can be extended. The batteries provide power only during the longer interruptions, reducing the peak loads on the battery and permitting the use of smaller batteries.

The ELDC goal is to reach the highest energy and power densities to get the smallest component volume and weight for a given applications.

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## **PROBLEM OF JOINT APPLICATION OF ZIGBEE AND WIFI**

ZigBee was developed for satisfying the market demand for a standards based on the cost-effective solution for wireless networking which supports low consumption of power, low data rates, reliability and security. Supported by an underlying IEEE specification, ZigBee can benefit from an increasingly large system that is being built around the standard. Although

using the license-free 2.4 GHz band is a strong catalyst for fast and worldwide market deployments, the presence of other wireless technologies across the same spectrum has risen concerns about potential coexistence issues.

Most of the worries have concentrated on IEEE 802.11 transmitters (commonly designated as WiFi transmitters). The IEEE 802.15.4 standard belongs to the class of spread-spectrum technologies. In contrast to a narrow-band signal, a spread-spectrum signal consists in using a bandwidth that is much larger than strictly required by the information that is being sent. Because the signal is spread over a large bandwidth, it can coexist with other narrowband signals, which generally incur a slight decrease in the signal-to-noise ratio over the spectrum being used. The spreading technique employed by IEEE 802.15.4 is direct sequence, which consists in using a pseudo-random code sequence to directly modulate the basic carrier signal and encode the data being transmitted. The resulting technology is called DSSS and is also found in the IEEE 802.11b/g standards. The IEEE 802.15.4 specification augments the opportunities for smooth coexistence by dividing the 2.4 GHz band into 16 non-overlapping channels, which are 2-MHz wide and 5-MHz apart. Another way to minimize the risk of interference is to reduce channel occupancy. The IEEE 802.15.4 PHY layer provides the ability to sample a channel, measure the energy, and report whether the channel is free from interference and thus clear to transmit. A ZigBee device may find itself sharing a channel with interferers, for instance other ZigBee devices. The IEEE 802.15.4 standard makes use of a simple "listen before talk" strategy. This specification includes by default the acknowledgment of received frames. The ZigBee standard adds network and application support on top of the IEEE 802.15.4 specification. In addition to coexistence techniques provided by IEEE 802.15.4 layers, ZigBee offers additional features to mitigate interference and to form a new network.

In presence of today's real WiFi applications (web surfing, file transfer, audio and video streaming), ZigBee operates satisfactorily, even in the most adverse interference conditions. Although ZigBee packets are delivered successfully, they can experience an increased latency due to a higher number of retransmissions. In real environments, WiFi interference is not an issue for ZigBee applications. When increasing WiFi's duty cycle and power level above what is achievable or available today (by arbitrarily increasing the channel occupancy), coexistence properties of ZigBee can be affected and packets can be lost. This is true in particular in IEEE 802.11b mode since interfering packets spend more time on air.

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## **INNOVATION IN THE WORLD OF HEADPHONES**

How much can we spend on a set of headphones? Temper that figure with the following facts: the headphones are wireless, and broadcast on a high-resolution RF frequency for maximum quality without wires.

This is a perfect form factor for use with a desktop PC – you'll never get the cable mangled by the wheel of your chair. They're also super-comfortable, clad in velvety fabric, and they nestle on your head like a creature designed to secretly consume the brain. They can pump out bass like nobody's business, ripping through your music and giving vocal recordings that extra warm edge. Basically, they're everything you want a pair of headphones to be.



This wireless headphone system utilizes Kleer's uncompressed digital wireless audio transmission and can serve up to four pairs of headphones. In addition, it gives you the freedom to travel up to 100m (line of sight) from your sound source.

But look over there at the price. We're pretty sure that wasn't the sort of figure you had in mind. Besides the wallet-emptying cost, Sennheiser's RS 180 headphones have other bad points.

Battery life, provided by a pair of rechargeable AAAs slipped under each ear cup, is around six hours. This is perfectly respectable in use, but still short enough that a night left off charge means a few irritating hours of silence while you fill them up again. They're a little leaky with the sound, so you'll struggle to get away with loud music in a shared environment. We also noticed a minute amount of subtle distortion in the signal, possibly due to wireless interference over the radio link, so you'll want proper wired headphones if you're after the absolute highest quality possible.

Perhaps most irritatingly of all, the charging points – located in the centre of the headband – have been designed in such a way that they grab and pull at your neck hair if you deign to rest them on your shoulders when not in use. That's really not a pleasant experience.

Weigh it up. The combined mass of the ludicrous price and multiple niggles doesn't quite balance with the truly great points these cans possess.

The main features of these headphones are not just dynamic transducer systems with powerful neodymium magnets for clear and detailed audio reproduction, but also multi-purpose transmitter and multi-receiver transmission. Which allows up to 4 people listening to the same source. Automatic level control for optimum audio levels and balance control for right/left volume adjustment also are inside. Devisers didn't forget about such important things as ergonomic and adjustable headband for an excellent and secure fit and extremely comfortable velour ear pads and headband cushions.

In the RS 180, Sennheiser delivers an excellent sound reproduction. Using an open, circumaural design, the headphones can breathe from both sides of the ear cups, offers us an excellent sound image.

We'd happily use them, but there's no way we'd buy them over a cheaper wired pair that would sweep away all of the bad points and only one of the benefits.

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## **FEDORA – LINUX-BASED OPERATING SYSTEM**

The Red Hat-sponsored organization has released the first public beta of the next version of its Linux-based operating system, Fedora 14, nicknamed "Laughlin". With this release comes a suite of new programs and features.

Most notably, the release will be the first version to fully incorporate Red Hat's VDI (virtual desktop infrastructure), called SPICE (Simple Protocol for Independent Computing Environments). This software will allow Fedora to host virtual desktops that can be accessed over a network.

"In the long term, Spice will let Fedora provide a better user experience in desktop virtualization. In the short term, Fedora gains an interesting new open-source technology that many people want to try out," the Fedora documentation states.

In addition to SPICE, Fedora 14 will try out a number of new technologies as well. It includes the Meego framework that will allow users to test the Meego tablet interface. It includes a demo version of the Sugar CRM software, as well as a set of Sugar developer tools. The software also provides tools for running the D functional programming language, and a beta of Perl 6, nicknamed Rakudo Star.

Laughlin, nicknamed after physics professor Robert Laughlin, will also support Intel's IPMI (Intelligent Platform Management Interface) remote server management software. It includes the next-generation services loading software called systemd, which is expected to be the default for Fedora 15, taking the place of the venerable init.

The software will offer version 4.5 of the KDE desktop and run version 2.6.35 of the Linux kernel.

Red Hat started Fedora in 2003 as the community release edition of its OS, RHEL, one that could be used to test new features. Thus far, more than 20,000 individuals have contributed to the Fedora Project, according to Red Hat. Sections of Fedora are later incorporated into RHEL, as well as into Oracle's Linux distribution, which borrows heavily from RHEL.

As with any beta software, Fedora will likely still have some bugs that need to be fixed, so it shouldn't be used on production systems at least until the final release. The developers are hoping that users report bugs they find back to the project so they can be corrected.

The finished Fedora 14 is expected to be released in November, joining a number of other Linux distributions being updated by year's end, including Canonical Ubuntu 10.10, RHEL 6 and Debian 6.

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## **HASKELL PROGRAMMING LANGUAGE**

In computer science, functional programming is a programming paradigm that treats computation as the evaluation of mathematical functions and avoids state and mutable data. It emphasizes the application of functions, in contrast to the imperative programming style, which emphasizes changes in state. Functional programming has its roots in lambda calculus, a formal system developed in the 1930s to investigate function definition, function application, and recursion. Many functional programming languages can be viewed as elaborations on the lambda calculus. Today functional programming is on its second wave of popularity because of the high level of abstraction of data processing that leads to seamless parallelization of computation on the new multi-core hardware or GPU.

At the conference on Functional Programming Languages and Computer Architecture (FPCA '87) in Portland, Oregon the committee's purpose was to consolidate the existing functional languages into a common one that would serve as a basis for future research in functional-language design. The result of the conference was a decision to introduce a new functional programming language called Haskell. It reduced unnecessary diversity of quite the same featured programming languages.

Haskell is a standardized, general-purpose purely functional programming language, with non-strict semantics and strong static typing. The primary control construct is the function. The first version of Haskell ("Haskell 1.0") was defined in 1990. In late 1997, the series

culminated in Haskell 98, intended to specify a stable, minimal, portable version of the language. Haskell features lazy evaluation, pattern matching, list comprehensions, type classes, and type polymorphism. Functions in Haskell do not have side effects. Haskell has a strong, static type system based on Hindley–Milner type inference. Principal innovation in the type system is to add type classes, which were originally conceived as a principled way to add overloading to the language. Monads are a general framework which can model different kinds of computation, including error handling, non-determinism, parsing, and software transactional memory. This is the most known feature of Haskell, that inspires developers to learn this programming language. Many useful algorithms can be implemented in Haskell in a more efficient manner because of its lazy evaluation by default. The main implementation is Haskell compiler is Glasgow Haskell Compiler (GHC). Other compilers exist, such as Hugs, Gopher, Yhc, Jhc. Hugs is most suited for learning Haskell. A series of programming languages were inspired by Haskell include Clean, Agda, Epigram, Curry.

As a conclusion, Haskell is a very powerful functional programming platform that introduces new programming paradigm and greatly improves efficiency of software development. Haskell has a very steep learning curve, however it can greatly improve speed of programming when switching to this pure functional lazy-evaluated language. Every programmer can find Haskell useful for academic purposes even if it is not used in production environment. It helps to develop strong functional programming skills as well as good understanding of the functional patterns presented in many modern object oriented languages. Students can open a new point of view on software development that greatly differs from a traditional OO or structured programming.

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## **LONG TERM EVOLUTION OF UNIVERSAL TERRESTRIAL RADIO ACCESS NETWORK**

Mobile networks continue to develop at an exciting pace. In ten years, mobile networks may well support services beyond that of today's multi-megabit fixed connections, while the amount of data traffic on mobile networks could surpass that of today's broadband connections in the next decade. As consumer demand grows for ever-richer services and connected lifestyles, mobile networks will evolve, and the mobile industry is already hard at work defining the technical solution that will allow mobile networks to meet the growing demand for wireless broadband services. The radio access technologies enabling these networks have been given the name Long Term Evolution of Universal Terrestrial Radio Access Network – or LTE for short.

LTE describes the evolution of mobile technology that will deliver users the benefits of faster data speeds and new services by creating a new radio access technology that's optimized for IP-based traffic and offers operators a simple upgrade path from 3G networks. Alongside LTE is work on the evolutionary development of the core architecture of mobile networks, called system architecture evolution (SAE). Together, they will offer operators networks with significant performance enhancements over 3G, with a target of two to four times the spectral efficiency of 3G/HSPA networks. This means LTE networks will be able to squeeze more bits

of data into the same amount of spectrum as 3G and HSPA networks, translating into increased data speeds and/or increased capacity.

LTE is the result of ongoing work by the 3rd Generation Partnership Project (3GPP), a collaborative group of international standards organizations and mobile-technology companies. 3GPP set out in 1998 to define the key technologies for the third generation of GSM-based mobile networks (3G), and its work has continued to define the ongoing evolution of these networks. Near the end of 2004, discussions on the longer-term evolution of 3G networks began, and a set of high-level requirements for LTE was defined: the networks must transmit data at a reduced cost per bit compared to 3G; they must be able to offer more services at lower transmission cost with better user experience; LTE must have the flexibility to operate in a wide number of frequency bands; it should utilize open interfaces and offer a simplified architecture; and it must have reasonable power demands on mobile terminals. Standardization work on LTE is continuing, and the first standards are due to be completed in the second half of 2007, with some operators projected to deploy the first LTE networks in 2009.

LTE defines new radio connections for mobile networks, and will utilize Orthogonal Frequency Division Multiplexing (OFDM), a widely used modulation technique that is the basis for Wi-Fi, WiMAX, and the DVB and DAB digital broadcasting technologies. The targets for LTE indicate bandwidth increases as high as 100 Mbps on the downlink, and up to 50 Mbps on the uplink. However, this potential increase in bandwidth is just a small part of the overall improvement LTE aims to provide. LTE is optimized for data traffic, and it will not feature a separate, circuit-switched voice network, as in 2G GSM and 3G UMTS networks.

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## **ARTIFICIAL NEURAL NETWORKS IN ROAD CONSTRUCTION**

Computer analysis and simulation is of vital importance to ensure the successful design and development of road engineering systems. In many areas, conventional modeling methods have produced system representations that are inaccurate and expensive in terms of processing power and memory requirements. Therefore the identification and modeling of dynamics systems have been analyzed; the use of artificial neural network methods has been proposed to improve the simulation process.

A neural network structure consists of large number of simple processing units that communicate by sending signals to each other over numerous weight connections. The applicability of road system models in simulation programs depends upon:

- the accuracy of their response to variations in parameters and circumstantial changes. Modeling can then be utilized to modify road system designs in order to improve behavior and performance;
- speed of response. Simulation for control purposes requires models with a faster or equivalent response time. If any adaptation is needed, it should be fast enough so that the controller is able to provide its proper action within the required amount of time.

An engineering system is a combination of components that act together and perform a certain objective. All real road systems change their performance with time and when the rates of change are significant, they are known as dynamic systems.

Every artificial neuron has three groups of variables, and these are:

- input variables, usually a linear summing function, which are initiated to act remotely on the system and are not directly related to it;
- output variables, usually in the form of a linear function, which are produced by the system as it interacts with its surroundings;
- internal parameters, which vary within the system but have no direct effect on the output variables and cannot be directly affected by input variables.

Neuron connections transmit signals generated by simple gain values or weights, which are multiplied by their inputs and are fully or partially broadcast to neurons in each network layer according to the network topology. The main purpose of any system modeling and analysis is to predict relevant input-output system relationships while operating under specific conditions.

Simulation studies are particular value for the research, design and development of road systems. Artificial Neural Networks (ANNs) are an attempt to incorporate the interconnectivity and parallel processing capability of the brain with the speed and precision of computer processors. This provides the means to learn to memorize and adapt the behavior of man-made dynamic systems as well as to recognize, recall and compare non-linear, multidimensional, input-output patterns and to cluster or organize data. An ANN modeling approach is used to understand a system in its totality, considering all linear and non-linear parameters that affect the system response.

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### **LAWYER'S ANALYTICAL FUNCTIONS IN THE ECOLOGICAL - ECONOMIC MONITORING**

The environmental information, problems and solved tasks diversity needs integration of the ecological informational and analytical space in interests of environmental safety and sustainable development of region.

Exactly for this purpose the system of ecological - economic monitoring was created. System management is based on combination interests of different users' categories (ecologists, physicians, lawyers, economists and managers) within the limits of the uniform information analytical interface. Physically such environment represents the Internet – a network which should be transformed to virtual ecological environment which gives the resources to the registered users.

The lawyer provides corresponding support of decisions which are accepted by the manager, frames legal models and techniques for definition of legality of actions which are prescribed by the ecologist, the physician and the economist. He also defines terms of carrying out of liquidating works according to the current legislation and has possibility to initiate claims to infringers of ecological safety, to define sources of indemnification of the injury.

The subsystem "Lawyer" carries out following functions:

- Display a card of area;
- Displays the chosen zone of ecological pollution to a card;

- Formation the interface for information reception about ecological, medical, social, economic actions and necessary resources for their carrying out;
- The reference to programs which carry out operations of visualization of a pollution zone;
- Formation the interface for information reception about legal aspects;
- Formation the interface for definition of sources of indemnification and calculation of the sum of the put injury;
- Formation the interface for definition and processing of real zones of pollution taking into account the information about all ideal zones which are included into its structure;
- Formation the plan performance of actions and transfer to its manager;

Functions of all experts are united in uniform system which carries out ecological economic monitoring of environment.

The Lawyer is the important part of all program complex. He makes such decisions as a choice of a source of indemnification - the sides on which fault there was a mistake. In this case he acts in a role of "judge".

The program complex is developed for use in city and other administrations as system which quickly makes decisions, considering the size of budgetary funds. The manager has possibility to work with different display levels of maps. Therefore, we are able to make decision's both in relation to small street and to whole country by means of different levels of maps. Under present conditions the given program is necessity.

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### **CHOOSING THE FORMAT OF E-BOOK. PDF OR DJVU?**

In the past few years, e-books are continuing to gain popularity. Nowadays a lot of literature is already translated into electronic form. The speed and convenience of working with many books in electronic form are much higher than with printed books. Therefore, the question of digitizing such books often arises. Choosing a format is one of the important issues that must be considered in processing of converting a printed book into electronic format. Nowadays there are several formats, in which electronic books are stored. The most popular of these formats are PDF and DjVu. When one of these formats is necessary to choose, there is a reason to consider features of these formats.

**PDF** (Portable Document Format) is created by Adobe Systems in 1993. It is used for representing two-dimensional documents in a manner independent of the application software, hardware, and operating system. It is designed to maximize accurate representation of the electronic document on any device. Accordingly, it shows the best results exactly at preservation of electronic documents. PDF supports RGB, CMYK, Grayscale, Lab, Duotone, Bitmap. PDF uses the JPEG format of compression for graphics and LZW for text. Accordingly, the best for this format is saving multimedia documents with fullcoloured and plenty of graphics artworks. The main advantage of PDF is wide compatibility (officially free program Acrobat Reader can be used for review PDF files) and the fact that most people have not heard about DjVu format. Disadvantages of PDF format is mainly technical, but they are significant. The main disadvantages of the PDF format are the inability to edit the files

effectively and the sensitivity to failures, when files are transferring, and strong loss in quality when there are the attempts to improve the quality of the bitmap file. One more technical disadvantage of PDF format is that sometimes you can't optimize the file size.

**DjVu** is a format, which develop dynamically. It is a computer file format designed primarily to store scanned documents, especially those containing a combination of text, line drawings, and photographs. It is the new technology of image compression that was developed in 1996 by AT & T Labs. It allows the distribution of documents with very high quality, digital documents and photos over the Internet. DjVu allows scanning colourful pages of books, magazines, catalogs, manuscripts, newspapers, historical documents etc. with high definition. Its unique feature is extremely compact when images with high resolution are storing (300 DPI and higher). The main feature of DjVu is using the dictionaries, and with sufficient uniformity of the image the compression can be performed hundreds of times. DjVu has advantages in size and quality compared to PDF in processing the images of black-and-white books, tables, and directories with few illustrations and inserts. DjVu is a lack of opportunity to make distortion with high compression, and a large number of different modes of compression leads to that a novice user can make low-quality file fairly easily. In addition, this format is optimized for transmission over a network so that you can view the page before it completely download.

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## **REASONS FOR USING IPv6**

To comprehend the IP addressing issues facing network administrators today, consider that the IPv4 address space provides approximately 4,294,967,296 unique addresses. Of these, only 3.7 billion addresses are assignable because the IPv4 addressing system separates the addresses into classes and reserves addresses for multicasting, testing, and other specific uses.

At January 2007 about 2.4 billion of the available IPv4 addresses are already assigned to end users or ISPs, so leaves roughly 1.3 billion addresses still available from the IPv4 address space. Despite this seemingly large number, IPv4 address space is running out.

Over the past decade, the Internet community has analyzed IPv4 address exhaustion and published mountains of reports. Some reports predict IPv4 address exhaustion by 2010, and others say it will not happen until 2013.

The growth of the Internet, matched by increasing computing power, has extended the reach of IP-based applications.

The pool of numbers is shrinking for the following reasons:

- Population growth
- Mobile users
- Transportation
- Consumer electronics

The ability to scale networks for future demands requires a limitless supply of IP addresses and improved mobility that DHCP and NAT alone cannot meet. IPv6 satisfies the increasingly complex requirements of hierarchical addressing that IPv4 does not provide.

Given the huge installed base of IPv4 in the world, it is not difficult to appreciate that transitioning to IPv6 from IPv4 deployments is a challenge. There are, however, a variety of

techniques, including an auto-configuration option, to make the transition easier. The transition mechanism you use depends on the needs of network.

An IPv6 address is a 128-bit binary value, which can be displayed as 32 hexadecimal digits. IPv6 should provide sufficient addresses for future Internet growth needs for many years to come. There are enough IPv6 addresses to allocate more than the entire IPv4 Internet address space to everyone on the planet.

IPv5 was used to define an experimental real-time streaming protocol. To avoid any confusion, it was decided to not use IPv5 and name the new IP protocol IPv6.

IPv6 would not exist were it not for the recognized depletion of available IPv4 addresses. However, beyond the increased IP address space, the development of IPv6 has presented opportunities to apply lessons learned from the limitations of IPv4 to create a protocol with new and improved features.

Mobility and security help ensure compliance with mobile IP and IP Security (IPsec) standards functionality. Mobility enables people with mobile network devices-many with wireless connectivity-to move around in networks.

The IETF Mobile IP standard is available for both IPv4 and IPv6. The standard enables mobile devices to move without breaks in established network connections. Mobile devices use a home address and a care-of address to achieve this mobility.

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## **SIP: A SYSTEMATIC INVESTMENT IN TELECOMMUNICATION SYSTEMS**

Proper and effective communication is a need nowadays, when most businesses rely on the telephony communication system. It is necessary for organizations to stay in touch with clients all over the world for a business to flourish and increase productivity. SIP trunking is one of the latest inventions that has created quite a buzz in the telecommunication world.

We have all heard about VOIP or Voice over Internet Protocol, the new age telecommunication system. It helps organizations to reduce phone bills to a large extent, including national as well as international calls. But most companies will already have a PBX phone system installed, which they won't obviously want to break down. And SIP trunking services Canada has come as a blessing in disguise since it is the only solution to getting the best of both worlds! With the help of SIP Trunks organizations can obtain all the benefits of a VoIP Trunk without having to de-install their legacy phone systems. According to different studies voice communication is the most important service in EHAS networks. Unlike VHF-HF systems, Wi-Fi networks are data IP networks that were not devised to provide voice service. Some of the VoIP services provided to final users are: free voice communication, voice mail, conference and communication to/from PSTN with prepaid cards. All VoIP terminals in our network use SIP (Session Initiation Protocol) to communicate each other, whereas Asterisk PBX communicates with peers using the proprietary IAX2 (Inter-Asterisk eXchange protocol). Related to VHF-HF networks the traditional way to connect radio networks to the Public Switched Telephone Network (PSTN) has been the employment of the so-called phonepatch devices. Nevertheless, this solution is excessively rigid, specially nowadays when VoIP has become widely used. For this reason, we have developed a software phonepatch that works with Asterisk. The EHAS Asterisk-phonepatch is highly configurable and compatible with HF



and VHF/UHF transceivers. Radio users operate a DTMF microphone to interact remotely with the phonepatch so they can receive and make calls to the entire EHAS VoIP network (with no cost) and the PSTN (prepaid card are used for outgoing calls).

The benefits of using VoIP business phone system are varied and so is the need for using managed SIP trunking:

- Consumers using VoIP services know beforehand their exact monthly size of the bill, except for international calls. There are hardly any billing errors and no extra or unnecessary charges on services. Therefore organizations nowadays are more likely to take services from a SIP provider.

- The VoIP solutions are software based and can be easily updated or expanded without investing further. This helps organizations to save a lot on operating costs, and SIP trunking for SMBs as well as SIP Trunking for enterprises is gaining popularity. Most VoIP service providers offer facilities such as unlimited local and long distance calls together along with the convenience of bundling both voice and data over one network. This is both effective as well as fast apart from being very cost effective.

- With the help of VoIP Trunks companies can benefit from simple 3 digit transfer easily to any other outlet, situated in any other city of the world or in any remote location.

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## **VEHICLE CONTROL WITH NEURAL NETWORKS**

Artificial neural networks (ANNs) stands for the artificial intellect systems. The architecture and the functionality of these systems are based on the architecture and the functionality of living creatures. The key element of this approach is the new information processing system, which consists of large amount of interconnected primitive processors (artificial neurons). They work together to solve different problems. It may seem that ANN is a novelty, but a lot of researches at this field were made long before mass introduction of computers at people's activities. After the period of an extreme interest (from 1943 to late 1960s) scientists almost forgot this field. Only at 1980s the amount of researches began to raise again. Now this trend is still in progress and the financing of such researches raises.

ANN have an outstanding ability to get important data from the massive of non-strict or difficult data. They can be used for a pattern or a regularity recognizing in case this patterns are too difficult to recognize by people as well as other computer systems. The well-tought ANN can be imagined as an expert in field it analyses the information. This expert can model hypothetical situations and answer WHAT-IF questions. Among the advantages of artificial neural networks adaptive learning, self-organizing, real-time operations performance and some others should be mentioned. Because of this properties ANNs are used in different human activities fields, especially those which need some forecast. Sales forecasting, industrial processes control, market research, risk management and target marketing.

Let us consider the vehicle control problem and its solving with using of artificial neural network. The idea is to have a vehicle that drives by itself and avoids obstacles in a virtual world. The input of neural network will be an array of the distances to the obstacles. This simulates the vision of the driver. The output will be the acceleration/brake since the brake is just a negative acceleration, and the other will be the change in direction.

Even though it is a 3D world, all the mathematics is 2D because the vehicle doesn't go into the 3rd dimension since it is not flying. Let us assign three main directions relative to the vehicle: left, right and center. The distances to the obstacles at these directions will determine the vehicle's behaviour. The eyesight of a driver can be described as an circle. Then according to part of the circle in which the obstacle is situated we will know is it on the left, on the right or in front of the vehicle. There is input information given according to every direction. Because the neural network is using a sigmoid function, the input needs to be between 0.0 and 1.0. 0.0 should mean that an object is touching the vehicle and 1.0 means that there is no object as far as it can see. The output from the neural network is also between 0.0 and 1.0 for the same reason as the input. For the acceleration, 0.0 means "full brakes on"; 1.0 means "full gas" and 0.5 means no gas or acceleration. For the steering, 0.0 means full left, 1.0 means full right and 0.5 means strait ahead. Then we need to train the neural network to approximate the function we need it to accomplish. After this, the vehicle can move avoiding obstacles in a virtual world, so the goal is achieved.

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## **MOTION CAPTURE**

Motion capture is a method that is used for creating animation of characters and objects. Systems based on the method are widely applied in movie-making and creating 3D-scenes and objects. Basically the method of motion capture reflects an opportunity to describe the essence of movements and translating those movements into digital form. The process of creating animation based on motion capture uses human's moves recorded with application-dependent cameras and special software. Received information processed with the help of strictly specialized programs is transformed into moves of object in realistic 3D-scene.

There are two main types of motion capture system implementation: marker and non-marker systems. Marker caption system uses special equipment consisting of suit and sensors, which reproduce movements in digital data. Motions of equipped person are captured by cameras, which then make full-scene 3D animation net ready for overlaying character or object. The major option of marker systems is possibility of quality facial motion capture. Non-marker caption system is based on systems of computer vision and pattern recognition. The filming process can be performed with non-professional equipment or without it.

Motion capture systems use various ways of motion transfer and its processing. Optical systems triangulate captured data to reflect the 3D position of a subject. Passive optical systems operate with data received from markers coated with a retroreflective material. Time modulated active marker bases on modulating the amplitude or pulse. Markerless motion capture is the less explored technique, but for its known features it is extensively used in interactive gaming simulation.

Non-optical magnetic systems compute location and focus by magnetic flux. Mechanical motion systems use "skeleton" in filming process acting as a structure for 3D object. Miniature inertial sensors and biomechanical models lie in a foundation of inertial technology, which is the most portable and is able to work with large capture areas.

The method of motion capture can replace live filming and manual 3D animation. It produces more realistic results and needs less time than traditional computer methods of

making animation. The complexity and amount of reproducing objects do not make big troubles for the systems. Complicated motions and actions can be easily transferred and overlaid on the net with the help of appropriate software, but movements that do not refer the laws of physics cannot be captured. This fact puts some limits for the capturing process and forces to observe certain rules to avoid deadlock conditions in handler's work. The method needs specific hardware, highly tailored programs and qualified scientists and engineers to be implemented. The cost of the software support, equipment, place of filming, personnel makes motion capture unattainable for little and low-budget projects, seriously complicating the process.

Diversity of released commercial motion capture systems for computer animation created a good base for further development and improvement of the method. Animation software vendors have integrated motion capture systems into products creating "off-the-shelf" performance animation systems.

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## **RECENT CHANGES IN JOURNALISM**

Development of new technologies has caused changes in different spheres of life and journalism is not an exception. There are many ways to cover recent events but citizen journalism is definitely a new phenomenon. It is the natural result of the fact that in today's world, where it seems like everyone owns a smartphone, it has become easier than ever to share events with the world as they unfold right in front of your eyes.

Today journalism is not only about reporting from the streets and events, but also from online happenings, all the things we enjoy and use as the benefits of tech society. With the popularization of sites like Twitter, Facebook, MySpace, LiveJournal and Contact, there has been a new trend of citizen journalism which encourages everybody to become an agent for transmission of news, regardless of experience, ethics, and, sometimes, even their commitment to accuracy. People now have unprecedented access to the tools of production and dissemination. There is no doubt that social media and modern technology can be an amazing tool that connects people around the world and allows sharing information in a way that has never been possible before. It seems like a good idea, but the reality of citizen journalism is that not everyone can be a journalist. Ordinary citizens are not trained journalists, and their work can often be biased, or their facts can be inaccurate, offensive, or otherwise lack credibility. In order for us to understand the problems with citizen journalism, we must first comprehend what professional journalism presents.

One of the most important factors of journalism is the adherence to a set of ethics. Without the need to respect the ethics that go along with being a real journalist, citizen journalists are given the freedom to pursue information in ways that could be detrimental to the entire image and reputation of journalism. Journalists must rely on a professional discipline for verifying information. But for citizen journalists who post their own videos online, it is extremely hard to verify sources, since they don't have the same resources as professional journalists. While conscientious professional journalists are careful to separate supportable evidence from opinion or speculation, many citizen journalists have a weaker sense of what

constitutes a reliable story, free of conjecture. Consumers of citizen journalism should understand that however well-intentioned a citizen journalist might be, reading the news with a skeptical eye is a good practice. Moreover, with the increasing speed that news travels these days, rumors through the Internet can often catch on fire within hours of release. That is only true if the information released is actual facts. When information is not accurate, it can have serious consequences. Some journalists seem to feel threatened by citizen journalists, who have had no instruction in journalism at all. Many journalists have spent a lifetime, learning, working, and perfecting their craft while others can just download some information on YouTube and be considered as a citizen journalist.

Ultimately, we must realize that journalism is not a hobby. It is a crucial profession that requires standard ethical practices. Let the professionals do their jobs without the constant competition that amateurs would provide.

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### **CHINESE SUPERCOMPUTERS TIANHE-1 AND TIANHE-1A**

Tianhe-I, in English "Milky Way Number One", is a supercomputer capable of over 2.5 quadrillion floating point operations per second. Located at the National Supercomputing Center in Tianjin, China, it is one of the few petaflops-level supercomputers in the world.

In October 2010, an upgraded version of the machine (Tianhe-1A) overtook ORNL's (Oak Ridge National Laboratory) Jaguar to become the world's fastest supercomputer, with a peak computing rate of 2.5 petaflops.

Both the original Tianhe-1 and Tianhe-1A use a Linux-based operating system.

Tianhe-1 was developed by the Chinese National University of Defense Technology (NUDT) in Changsha, Hunan. It was first revealed to the public on 29 October 2009, and was immediately ranked as the world's fifth fastest supercomputer in the TOP500 list released at the 2009 Supercomputing Conference (SC09) held in Portland. Tianhe achieved a speed of 563 teraflops in its first Top 500 test and had a peak performance of 1.2 petaflops. Thus at startup, the system had an efficiency of 46%. Originally, Tianhe-1 was powered by 4,096 Intel Xeon E5540 processors and 1,024 Intel Xeon E5450 processors, with 5,120 AMD graphics processing units (GPUs), which were made up of 2,560 dual-GPU ATI Radeon HD 4870 X2 graphics cards.

In October 2010, Tianhe-1A, a separate supercomputer, was unveiled at HPC 2010 China. It is now equipped with over 14,000 Xeon X5670 processors and over 7,000 Nvidia Tesla M2050 general purpose GPUs. 2,048 heterogeneous processors are also installed in the system, but their computing power was not counted into the machine's official Linpack statistics as of October 2010. Tianhe-1A has a theoretical peak performance of 4.7 petaflops. NVIDIA suggests that it would have taken "50,000 CPUs and twice as much floor space to deliver the same performance using CPUs alone." The current heterogeneous system consumes 4.04 megawatts compared to over 12 megawatts had it been built only with CPUs.

The Tianhe-1A system is composed of 112 compute cabinets, 12 storage cabinets, 6 communications cabinets, and 8 I/O cabinets. Each compute cabinet is composed of four frames, with each frame containing eight blades, plus a 16-port switching board. Each blade is

composed of two compute nodes, with each compute node containing two Xeon X5670 6-core processors and one Nvidia M2050 GPU processor. The system has 3584 total blades containing 7168 GPUs, and 14,336 CPUs. The total disk storage of the systems is 2 Petabytes, and the total memory size of the system is 262 Terabytes.

The supercomputer is installed at the National Supercomputing Center, Tianjin, and is used to carry out computations for petroleum exploration and aircraft simulation. It is an "open access" computer meaning it provides services for other countries.

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## **GRAPHENE ELECTRONICS**

In 1960, at the beginning of the information revolution, Gordon Moore, later one of the founders of the corporation Intel, suggested that the number of transistors on a chip will double roughly every two years. Subsequent development of computers was going in accordance with this assumption, called "Moore's Law".

However, it's necessary to use new raw, not to reach the end point of the Moore's Law. Scholars have noted that the future of computer depends on the development and use of new materials for their production.

Silicon as the basis of microelectronics firmly won a leading position in the space of high technology. It has been studied thoroughly and has all the necessary properties, which strengthen its position as the main electronics' raw material. Nevertheless, there are other contenders for leadership as a semiconductor material. The most sensational material is graphene.

Graphene is a monatomic layer of carbon atoms, which, like graphite, has a hexagonal lattice. Thereafter, graphite is stacked graphene layers. For the first time pure graphite was synthesized in 2004.

Graphene is truly unique. In addition to its unique single-atom thick, graphene is 10 times stronger than steel and is an excellent conductor even at room temperature. Despite the incredible strength, graphene is lightweight and has great flexibility — can be subjected to 20% deformation without affecting the crystal lattice. Graphene has high thermal conductivity, which is very important for electronic devices. What is also important is the great amount of carbon in nature that can make graphite cheap at the optimum preparation method.

But the most interesting in its electronic property is the high mobility of electrons (1/300 the speed of light). It turned out that graphene's charge carriers behave like relativistic particles with zero effective mass. Such graphene properties allow us to hope that it will be possible to create devices capable of operating at terahertz frequencies, which are not available for silicon.

Thus, scientists from IBM Research have already succeeded in creation of graphene transistors on practice that have a gate length of about 240 nm and to reach with them 100 GHz operating frequency. This greatly exceeds the capabilities of the best examples of silicon transistors with the same gate length (about 40 GHz).

Insufficient knowledge and the lack of reliable graphene formation methods slow the development of graphene electronics. Despite the great number of challenges, the science is

successfully moving forward in this direction. There is a large share of confidence that the obstacles will overcome, and graphene will bring a new milestone in the development of high technology.

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### **3D PRINTING**

3D printing is a form of additive manufacturing technology where a three dimensional object is created by laying down successive layers of material. 3D printers are generally faster, more affordable and easier to use than other additive manufacturing technologies. 3D printers offer product developers the ability to print parts and assemblies made of several materials with different mechanical and physical properties in a single build process. Advanced 3D printing technologies yield models that closely emulate the look, feel and functionality of product prototypes.

A large number of competing technologies are available to do 3D printing. Their main differences are found in the way layers are built to create parts. Some methods use melting or softening material to produce the layers (SLS, FDM) where others lay liquid materials that are cured with different technologies. In the case of lamination systems, thin layers are cut to shape and joined together.

A comparison of two ceramic art objects. The original was created by John Balistreri and then duplicated using a 3D Scanner and printed using 3D Ceramic Rapid Prototyping.

Each method has its advantages and drawbacks, and consequently some companies offer a choice between powder and polymer as the material from which the object emerges. Generally, the main considerations are speed, cost of the printed prototype, cost of the 3D printer, choice of materials, colour capabilities, etc.

One method of 3D printing consists of an inkjet printing system. The printer creates the model one layer at a time by spreading a layer of powder (plaster, or resins) and inkjet printing a binder in the cross-section of the part. The process is repeated until every layer is printed. This technology is the only one that allows for the printing of full colour prototypes. This method also allows overhangs. It is also recognized as the fastest method.

In DLP, or Digital Light Processing, a vat of liquid polymer is exposed to light from a DLP projector under safelight conditions. The build plate then moves down in small increments and the liquid polymer is again exposed to light. The process repeats until the model is built. The liquid polymer is then drained from the vat, leaving the solid model. The ZBuilder Ultra is an example of a DLP rapid prototyping system.

Fused deposition modeling (FDM), a technology developed by Stratasys that is used in traditional rapid prototyping, uses a nozzle to deposit molten polymer onto a support structure, layer by layer. Another approach is selective fusing of print media in a granular bed. In this variation, the unfused media serves to support overhangs and thin walls in the part being produced, reducing the need for auxiliary temporary supports for the workpiece. Typically a laser is used to sinter the media and form the solid. Examples of this are SLS (Selective laser sintering) and DMLS (Direct Metal Laser Sintering), using metals.

Finally, ultra-small features may be made by the 3D microfabrication technique of 2-photon photopolymerization. In this approach, the desired 3D object is traced out in a block of gel by a focused laser.

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## **ROBOTS AND NANOTECHNOLOGIES**

A robot is a virtual or mechanical artificial agent. In practice, it is usually an electro-mechanical machine which is guided by computer or electronic programming, and is thus able to do tasks on its own. It is an electric machine which has some ability to interact with physical objects and to be given electronic programming to do a specific task or to do a whole range of tasks or actions.

Leonardo da Vinci (1452–1519) sketched plans for a humanoid robot around 1495. The Japanese craftsman Hisashige Tanaka (1799–1881), known as "Japan's Edison" or "Karakuri Giemon", created an array of extremely complex mechanical toys, some of which served tea, fired arrows drawn from a quiver, and even painted a Japanese kanji character. The first truly modern robot, digitally operated and programmable, was invented by George Devol in 1954 and was ultimately called the Unimate.

While there is no single correct definition of "robot," a typical robot will have several, or possibly all, of the following characteristics.

Mental agency: the more the control system seems to have agency of its own, the more likely the machine is to be called a robot. An important feature of agency is the ability to make choices.

Physical agency: however, for many laymen, if a machine appears to be able to control its arms or limbs, and especially if it appears anthropomorphic or zoomorphic (e.g. ASIMO or Aibo), it would be called a robot.

At present there are 2 main types of robots, based on their use: general-purpose autonomous robots and dedicated robots.

General-purpose autonomous robots are robots that can perform a variety of functions independently. General-purpose autonomous robots typically can navigate independently in known spaces, handle their own re-charging needs, interface with electronic doors and elevators and perform other basic tasks.

Commercial and industrial robots are now in widespread use performing jobs more cheaply or with greater accuracy and reliability than humans. They are also employed for jobs which are too dirty, dangerous or dull to be suitable for humans. Robots are widely used in manufacturing, assembly and packing, transport, earth and space exploration, surgery, weaponry, laboratory research, and mass production of consumer and industrial goods.

Nanorobotics is the still largely hypothetical technology of creating machines or robots at or close to the scale of a nanometer (10<sup>-9</sup> meters). Also known as nanobots or nanites, they would be constructed from molecular machines. So far, researchers have mostly produced only parts of these complex systems, such as bearings, sensors, and Synthetic molecular motors. Researchers also hope to be able to create entire robots as small as viruses or bacteria, which

could perform tasks on a tiny scale. Possible applications include micro surgery (on the level of individual cells), utility fog, manufacturing, weaponry and cleaning.

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## **CLOUD COMPUTING**

Cloud computing has been a possible solution for providing a flexible, on demand computing infrastructure for a number of applications recently. Many companies and research institutes show great interests in cloud computing. A cloud computing environment has several key features:

- 1) it is massively scalable,
- 2) can be encapsulated as an abstract entity that delivers different levels of services to customers outside the Cloud,
- 3) it is driven by economies of scale,
- 4) the services can be dynamically configured (via virtualization or other approaches) and delivered on demand.

As cloud computing has these features, the scheduling strategy for workflows on a cloud computing platform should consider the new features. First, cloud provides services for multi-users. So the scheduling strategy must cater to the different QoS requirements of different users. Second, there will be many workflow instances on the cloud platform at the same time. So the scheduler should be able to schedule multi-workflows. Last but not the least, new workflow may be started at any time. A lot of Grid workflow management systems have been developed to facilitate the composition and execution of workflow applications over distributed resources. Many heuristics have also been proposed for workflow scheduling in order to optimize a single objective, such as minimizing execution time or budget constrained. However, more objectives need to be considered when scheduling workflows on cloud based on users' QoS requirements. Most algorithms developed for scheduling workflow focus on a single Quality of Service (QoS) parameter such as execution time or cost. However, if we consider more than one QoS parameter (e.g. execution cost and time) then the problem becomes more challenging.

To address the problem mentioned above, we introduce a scheduling strategy for multi-workflows with multiple QoS constrained for cloud computing in this paper.

According to the key features of cloud and the characteristics of workflow applications, we have considered four factors which affect the total makespan and cost of workflow greatly. On the basis of these four factors, we generate a scheduling to satisfy with the users' QoS requirements and minimize the makespan and cost of workflows and increase the success rate of workflow scheduling (A success schedule is defined that the workflow is finished and meet the QoS requirements of the users).

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## **A USE OF INTERNET IN EDUCATION**

Nowadays the Internet is the biggest resource of information in the world. It is used for communication, searching the information, education, entertainment and work. Today Internet gives people an opportunity to learn subjects in different ways, such as blogging, webinars, wiki-like systems, podcasts, screencasts, RSS and on-line testing systems.

I want to tell you about using some of these systems in education.

Blog is a system for publishing and discussing materials in the Web. It can be used by a teacher as a place for publishing lections, themes, seminars, some pictures or multimedia content to share it with students. The system of commentation can be used for asking questions and receiving answers for them. Teacher can divide his blog into different courses and let reading or discussing some course for particular group of students.

Webinar is an on-line seminar, lection or presentation based on web-technology to represent the information to the audience with best efficiency. During the webinar teacher can switch between prepared presentation, live speech and some video content. A teacher can run webinar from any place, that is connected to the Internet and students can watch and listen to it on different continents, so there is no problem of geographic location of every participant of webinar.

Podcast is a series of audio- or video-content that are released episodically and are free to download through web. Podcast are very useful, because listening to audio records or viewing video clips is more useful, than reading texts. A student can also listen to a podcast several times, and this is the biggest advantage of podcast over the standard lection.

Screencasts are a particular type of podcasts. Screencast is a video clip, which shows the presenter's computer display. It is very useful, especially in learning the computer science.

RSS (Really Simple Syndication) is a quick method to receive the last blog posts, podcasts and news automatically. It is very useful, if the teacher has his own blog.

Learning materials is not the only one side of education process. Testing students' progress is important too, and a teacher can use Internet technology for it.

Today people can use a very good educational web-system called Moodle, which is possible to represent the material in different forms, to check student's knowledge and to manage the communication between a student and a teacher.

Wiki engine lets the teacher create a report, which can be read or even edited. The last one is very useful, because a teacher can create some kind of a test giving student a task to find and correct the mistakes in the report he wrote. And when the report is edited the teacher doesn't have to search for the previous variant of the text, because the system gives him a possibility not only to watch both variants of the report, it also marks edited fragments with color. Wiki engine can be used for collaborative editing either.

## **SIMD EXTENSIONS OF THE x86 ARCHITECTURE**

The x86 architecture has leading position at personal computer market now. It has come long way of the evolution and acquired wide range of upgrades. One of the most important and developed improvement is SIMD extension.

SIMD (Single instruction, multiple data) is a class of parallel computers in Flynn's taxonomy. It describes computers with multiple processing elements that perform the same operation on multiple data simultaneously. Thus, such machines exploit data level parallelism. SIMD model is effective for various tasks, for example, vector and matrix processing, processing of multimedia data, 3D modeling, etc.

The first SIMD extension was MMX (Multi Media extension). It was proposed and implemented by Intel. MMX defined eight 64-bit registers. Each of them could be divided into eight bytes, four words or two double words. MMX provided only integer operations. To avoid compatibility problems with the context switch mechanisms in existing operating systems, these registers were aliases for the existing x87 FPU stack registers (so no new registers needed to be saved or restored). This registers was directly addressable (random access).

AMD, the main Intel's competitor, proposed an extension for MMX which could work with floating-point named 3DNow!. An advantage of 3DNow! is possibility to add or multiply the two numbers that are stored in the same register. Intel implemented this feature only in SSE3 which was presented much later. A disadvantage is that it only stores two numbers in a register.

The next step of SIMD extension development is SSE (Streaming SIMD Extension). Intel introduced this feature in 1999 in their Pentium III series processors as a reply to AMD's 3DNow! (which had debuted a year earlier). Anyway AMD processors have been supporting SSE since Athlon XP. SSE is improved variant of MMX. It can work with floating point format and has 8 new 128-bit registers. Intel continuously improving this extension. As a result five generations of SSE (SSE – SSE5) are presented now. All versions are backward compatible so processor with SSE4 can perform operations of first SSE and MMX.

The newest achievement of SIMD extension is Intel's AVX (Advanced Vector Extensions). Its main innovation is new big 256-bit registers. In short future new Intel's and AMD's processors will support AVX.

Software support of SIMD also is very important, because without it hardware becomes useless. Software developers should know how to use power of extensions. There are three ways:

- direct manual code optimization, which is very hard process, although most effective;
- the use of a SIMD compiler, which may produce unexpected results;
- the last way is to use standard application libraries, optimized and distributed by CPU makers themselves. Those libraries contain standard functions to perform most popular tasks.

The last option is the most popular.

## OVERVIEW OF COLOR E-PAPER TECHNOLOGIES

For almost three decades, electronic paper technologies have been evolving to combine the flexibility of digital information with the familiarity, quality, and convenience of a paper-like substrate. More than a dozen companies have announced work on active e-paper programs, and there are a lot of start-ups coming to existence as well. We compared two most perspective technologies of e-ink paper with traditional technology.

**E-Ink traditional.** The principal components of electronic ink are millions of tiny microcapsules, which size is about the diameter of a human hair. In one stage, the microcapsules contain positively charged white particles with negatively charged black particles suspended in a clear fluid. Applying a negative electric field, causes the white particles to move to the top of the microcapsule where they become visible to the user. Thus the surface area where the white particles have moved to appears white. The black particles are simultaneously moved to the bottom of the display, where they are hidden. When the process is reversed, the black particles move to the top to make that section of the display appear dark. To display a range of colors, pixels must be grouped in trios. In each trio, one pixel is filtered red, another is filtered green, and the third is filtered blue. Varying the intensity of each pixel within the trio generates different colors.

**Electrofluidic technology.** Electrofluidic displays do just that. In each pixel, a polar pigment dispersion placed inside a tiny reservoir. The reservoir comprises <5-10% of the viewable pixel area and therefore the pigment is substantially hidden from view. Voltage is used to pull the pigment out of the reservoir and spread it as a film directly behind the viewing substrate. As a result, the display takes on color and brightness similar to that of conventional pigments printed on paper. When voltage is removed liquid surface tension causes the pigment dispersion to rapidly recoil into the reservoir. More advanced pixel structures increase brightness and allow bistable operation, but use similar operating principles and similarly simple device construction.

**Photonic Ink.** P-Ink works by controlling the spacing between photonic crystals, which affects the wavelengths of light they reflect. Photonic crystals are the optical equivalent of semiconductor crystals. While semiconductor crystals influence the motion of electrons, photonic crystals affect the motion of photons. With P-Ink, each pixel in a display consists of hundreds of silica spheres. Each of these photonic crystals is about 200 nanometers in diameter and embedded in a spongelike electroactive polymer. These materials are sandwiched between a pair of electrodes along with an electrolyte fluid. When a voltage is applied to the electrodes, the electrolyte is drawn into the polymer, causing it to expand. The swelling pushes the silica beads apart, changing their refractive index. As the distance between them becomes greater, the wavelengths reflected increases .

**Conclusions.** Traditional e-ink technology is the most widely spread for producing e-books nowadays, but it still has low level of whiteness and contrast characteristics of the visible surface. And both the traditional and electrofluidic technologies decrease the resolution of the e-paper three times, if they appear in color, in comparison to their monochromic analogs. This is due to the fact that one pixel of such e-paper can have only one of three main colors (red, green or blue).

## **SATELLITE COMMUNICATION**

The transmission of information over long distances in short time is one of the main features of modern information technology. Satellite communication is used to implement such hard decisions.

A communications satellite (COMSAT) is an artificial satellite stationed in space for the purpose of telecommunications. The satellite itself is also known as the space segment, and is composed of three separate units, namely the fuel system, the satellite and telemetry controls, and the transponder. The transponder includes the receiving antenna to pick-up signals from the ground station, a broad band receiver, an input multiplexer, and a frequency converter which is used to reroute the received signals through a high powered amplifier for downlink. The primary role of a satellite is to reflect electronic signals. In the case of a telecom satellite, the primary task is to receive signals from a ground station and send them down to another ground station located a considerable distance away from the first. This relay action can be two-way, as in the case of a long distance phone call. Another use of the satellite is when, as is the case with television broadcasts, the ground station's uplink is then downlinked over a wide region, so that it may be received by many different customers possessing compatible equipment. Still another use for satellites is observation, wherein the satellite is equipped with cameras or various sensors, and it merely downlinks any information it picks up from its vantagepoint.

The possibility of using artificial satellites for radio communications over global distances had been discussed before World War II by Arthur C. Clarke.

The first and historically most important application for communication satellites was in intercontinental long distance telephony. The fixed Public Switched Telephone Network relays telephone calls from land line telephones to an earth station, where they are then transmitted to a geostationary satellite. Satellite phones connect directly to a constellation of either geostationary or low-earth-orbit satellites. Calls are then forwarded to a satellite teleport connected to the Public Switched Telephone Network. With time-division multiple access (TDMA), each ground station is assigned a time slot on the same channel for use in transmitting its communications. By amplifying a single carrier frequency in each satellite repeater, TDMA ensures the most efficient use of the satellite's onboard power supply.

Another fascinating applications of satellites is GPS (Global Positioning System). Its primary application is navigation. There is a network composed of 24 to 32 satellites in Medium Earth Orbit spaced equally around the world in overlapping pattern for this purpose. They use low microwave frequencies for transmission.

It is difficult to imagine life without satellite communications. Devices containing modules to work with the satellites, are becoming cheaper and more accessible. It's all part of progress that makes our life much easier.

**HYBRID FIBER RADIO — CONCEPTS AND PROSPECTS**

Radio networks provide users the attractive feature of untethered connectivity for a range of applications including cellular communications, wireless local area data networks, and broadband fixed wireless access. The application of optical fiber in these networks for the transport and distribution of radio signals brings a number of benefits, including high-performance remoting links and reduced infrastructure costs.

The advantages of the optical fiber as a transmission medium, such as low loss, large bandwidth characteristics, small size, and low cable cost, make it the ideal solution for efficiently transporting radio signals from the central office (CO) to the remote antenna sites. In addition, optical fiber has significant weight advantages over coaxial cable. Hybrid fiber radio (HFR) is an essential technology for the integration of broadband wireless and optical access networks and enables a flexible access network infrastructure capable of offering broadband wireless connectivity to a range of services and applications.

Current wireless network architectures are characterized by centralized switching nodes that are interconnected to distributed antenna BSs via microwave links. In future broadband picocellular network architectures, because of the large capacity and large number of BSs, radio networks may be dimensioned in such a way that there will be a number of clusters of BSs serviced by a switching node. One of the key challenges in implementing HFR systems is developing suitable optical network architectures for efficient distribution of the radio signals while also maintaining a simple and compact BS configuration.

A key aspect of the successful deployment of hybrid fiber radio systems is the development of appropriate antenna BS technologies. In addition to the required optical and electrical performance, these optical–electrical–air interfaces should ideally feature at least three interrelated characteristics: high efficiency, low cost, and small size. As HFR systems operating in the millimeter-wave frequency region will typically require a larger number of BSs because of the smaller coverage area at these frequencies, the amount of DC power required to operate the remote antenna units has to be minimized.

RF-over-fiber is probably the most straightforward radio signal distribution scheme because the wireless signals are transported directly over the fiber at the radio carrier transmission frequency without the need for any subsequent frequency up- or down-conversion at the remote antenna BSs.

Hybrid fiber radio systems are being considered as a viable technology for providing access to broadband wireless communications, in a range of applications, including last mile solutions, extension of existing radio coverage and capacity, and next generation ultrabroadband data communications.

Much progress has been made in the development of HFR technologies for wireless networks operating at a range of frequencies, including next generation systems that extend well into the millimeter-wave frequency region. These new enabling technologies include high-performance optical and RF components, new signal generation and data modulation techniques for down- and upstream signal transport, novel architectures incorporating optical networking concepts, and innovative approaches for the integration of optical and RF components to realize high-performance compact antenna BSs.

## **SECURITY IN WIMAX NETWORKS**

Mobile WiMAX appeared in 2005, now adopted by many organizations to provide wireless broadband access.

Varied and numerous attacks were a direct consequence of the existence of vulnerabilities standard. Increased security and proper authentication are essential requirements for mobile networks.

Wireless WiMAX is one of the hottest themes in recent years. This technology and its development prospects and application are discussed at numerous conferences and forums, including international ones.

Wireless networks have become an integral part of IT infrastructure, but interest in it, like many years ago, remains very large. Each step in the development of broadband wireless access systems opens up new opportunities for market players and users.

The sector of wireless and mobile technologies - is one of the fastest worldwide developing market segments. The interest and the need of wireless technologies implementation is noted by the major oil and gas companies, energy sector, in locations where wired infrastructure is unprofitable or insufficiently developed. Market research shows that innovative wireless networking solutions are used by government and commercial enterprises in various industries, banks and financial centers, airports and transport companies, hotels and business centers, and enterprises of the military-industrial complex. Wireless broadband access - are actively growing segment of the telecommunications market. The latest developments are in demand and of great importance in the development of modern industry and economy.

Wireless means that data transmitted via radio, i.e., data are available for everyone, so there is a major problem of the security and confidentiality of transmitted information, as well as the problem of determining of the client authenticity. It was suggested two mechanisms: data encryption and client authentication to solve these problems.

Improved security conditions and the proper authentication are the basic needs of the mobile network.

Improving the safety and proper conditions for establishing the authenticity are the basic needs of the mobile network.

The purpose of this work is to investigate possible attacks on the main protocol standard - Privacy and Key Management protocol (PKM).

- opportunity to re-use TEK keys, whose lifespan has expired;
- unsafe use of DES encryption.

In this paper I have examined the mechanisms of information security in mobile network standard IEEE 802.16. The primary authentication protocol and possible attacks related to the key distribution authorization, as well as methods of combating these attacks were analyzed. The static analysis was tested by means of BAN-logic.

The work is not completed at this time. Further, at based on the theoretical findings, scheduled for simulation of all events described to confirm results. The ultimate goal of the work will further study the proposed solutions in a real physical network.

The Global Positioning System (GPS) is a space-based global navigation satellite system that provides reliable information about location and time in all weather conditions, at all times and anywhere on or near the Earth when and where there is an unobstructed line of sight to four or more GPS satellites. In present time many people use GPS but few of them begin to think how this communication network was created and developed.

The idea to create satellite navigation was born yet in the 50s. Later when the USSR launched the first Earth satellite, the American scientists headed by Richard Kershner watching for a signal, which was going from the Soviet satellite, discovered that due to the Doppler Effect the frequency of the received signal increases approaching to the satellite and diminishes at moving away from it. The main point of the discovery was that if someone knows the exact coordinates of some object on Earth, it makes possible to measure a position and speed of the satellite and vice versa, if you exactly know an object's position, it is possible to define its speed and coordinates. This idea was realized in 20 years. The first tested satellite was launched into orbit on 14<sup>th</sup> July 1974 in the USA and the last from all 24 satellites necessary for the full coverage of earth surface was launched into orbit in 1993. Thus, GPS was added to the US armament.

Originally GPS is the global positioning system developed as an obvious military project. They use it in a number of the following ways:

- Navigation: GPS allows soldiers to find objectives even in the dark or unfamiliar territory, and to coordinate the movement of troops and supplies. In the US armed forces commanding officers use the Commanders Digital Assistant and lower ranks (non-commissioned officers) use the Soldier Digital Assistant.

- Target tracking: Various military weapon systems use GPS to track potential ground and air targets before flagging them as hostile. These weapon systems pass target coordinates to precision-guided munitions to allow them to engage targets accurately. Military aircraft, particularly in air-to-ground roles, use GPS to find targets. For example, gun camera video from AH-1 Cobras in Iraq showed GPS coordinates that can be viewed with special software.

- Missile and projectile guidance: GPS allows accurate targeting of various military weapons including ICBMs, cruise missiles and precision-guided munitions.

- Artillery projectiles: Embedded GPS receivers able to withstand accelerations of 12.000 g or about 118 km/s<sup>2</sup> have been developed for use in 155 millimeters howitzers.

After Korean Air Lines Flight 007, carrying 269 people, was shot down in 1983 through careless straying into the USSR's prohibited airspace, in the vicinity of Sakhalin and Moneron Islands, President Ronald Reagan issued a directive to make the GPS freely available for civilian use.

As a conclusion I would like to consider the GPS system as substantially facilitating the conduction of urgent military tasks but it is also should be mentioned that GPS is important not only for military but also for civilian usage.

## **COMPUTER ASSISTED LANGUAGE LEARNING**

A new technology named CALL (Computer Assisted Language Learning), which allows you to combine existing methods of teaching foreign languages with the help of the computer started to develop rapidly in the end of 20<sup>th</sup> century [1]. But nowadays, with the help of internet it is developing even more significantly because using the net people from all over the world can ask native speakers for help and also help each other. The use of multimedia technology tends to fully simulate the environment, linguistic and communicative reality, and strengthen the basic methodological principles of teaching foreign languages: skills in listening, speaking, reading and writing. An important condition for successful application of computer in language education is to create a powerful means of support, which should consist of teaching computer courses, electronic dictionaries, machine translation, various reference books, text programs, spelling systems, forums and specialized web resources.

There is an interesting feature of the computer, which is revealed when using it as a device to train others and as an assistant in learning - his inanimation. The machine can be "friendly", chat with the user and in some moments provide an appropriate support, but it will show no sign of irritability, and will not show that it got bored. In this sense, the use of computers is perhaps the most useful for the individualization of certain aspects of teaching.[2]

The advantages of using computers in language teaching lies not only in the fact that students can perform many additional tasks, but in that the tasks themselves become more interesting. As it was mentioned above informational systems can provide a special experience through interacting (dialogues) using recorded speech of native speakers. These recording can give great example of pronunciation and essential word choosing techniques as one of the steps to use the language more appropriately in the needed professional field. On the other hand the students can take the initiative, which is not always possible with traditional training. With the class of 30 students it's unlikely for each of them to be able to use the teacher when needed, ask questions when they have appeared and immediately get answers.[3] The vast number of language learning resources in the internet help a lot with this as well. The other advantage is reduction of paper work which shows great impact on the speed of learning and the amount of information taken at the time, especially in word-remembering. Though in some cases the speed and amount can also suffer the influence of students' capability to receive information.

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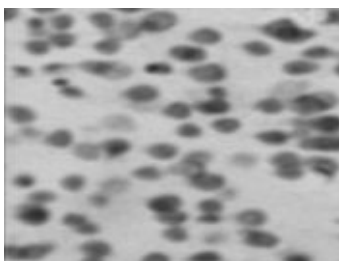
## FROM SEGMENTATION TO BINARIZATION OF GRAY-LEVEL IMAGES

Image segmentation is a key step in many applications in pattern recognition, computer vision and image understanding to allow further image content exploitation in an efficient way. The result of segmentation is a partition of a gray-level image into a number of regions, which are homogeneous according to some criteria and belong either to the foreground or to the background. the automatic distinction between foreground and background is a complex task, especially when it is based only on the analysis of gray-level information, without involving other features, such as the shape expected to characterize the foreground components.

In fact, human observers often classify sets of pixels with the same gray-level in different manners, i.e., those which belong to the foreground, located in certain parts of the image, and to the background, if located in other parts, depending on the local context.

For images that are perceived as binary, e.g., written documents, there is the process so called binarization which distinguishes the foreground from the background, since it refers to the conversion of a gray-level image into a binary image. In simple cases, binarization can be achieved by thresholding the image, i.e., by assigning all the pixels with gray-level lower than a given threshold to either the background or the foreground, and all the remaining pixels to the other set. However, often more sophisticated processes are necessary. This is the case when regions with noticeably different gray-levels are all regarded as of interest, or when regions with the same gray-level can be regarded as belonging to the foreground or to the background, depending on the local context.

Typical examples are biological images, e.g., those including sets of cells or neurons, where foreground pixels are characterized by a variety of gray-levels, depending on their intrinsic nature, their position within the specimen, the illumination, and so on, and the background is not uniform. To obtain a partition of these images, it is convenient to resort to the watershed transformation. The basic idea of this transformation is to detect in the gray-level image a suitable set of seeds from which to perform a *growing process*.



*Fig. 1: Running example. Cells of the cerebral cortex of mammals.*

Fig. 1, the foreground is perceived as locally darker with respect to the background. Some regions that the experts classify as belonging to the foreground are lighter than most of the other regions assigned by them to the foreground and their gray-levels do not remarkably differ from the gray-levels in portions of the image that the same experts classify as belonging to the background.

## **TEMS CELLPLANNER FOR MOBILE RADIO NETWORKS**

Planning of mobile radio network is a fundamental step in the process of its development. Objective of this process is attainment of optimal "efficiency/cost" ratio. Mobile network design is a complicated and labour intensive process because it takes into account a large number of different factors (geographical, geophysical, social and anthropogenic factors). It caused developers demand for whichever software products could simplify a planning of mobile radio network. Nowadays different companies offer software and hardware-software complexes which can design, analyze and optimize communications networks. The next paragraph will be about one of them.

TEMS CellPlanner Universal is a tool for designing, realizing, and optimizing mobile radio networks. Designed and developed by Ericsson, it assists the user with network dimensioning, traffic handling, site configuration, and frequency/code planning for GSM/GPRS/EDGE/LTE and WCDMA based systems. TEMS CellPlanner Universal meets the needs of today's complex radio networks. It features open interfaces, a new more flexible architecture, and support for all major technologies. It also utilizes unique, patented algorithms for accuracy and speed. The modular platform makes it easy to customize and add new functionality. TEMS CellPlanner Universal provides a flexible system configuration and an efficient working environment.

TEMS CellPlanner provides two well-proven, state-of-the-art radio propagation models, the 9999 and the Urban model. The 9999 model is used for predictions in rural, suburban, and urban areas. The Urban model is aimed at dense urban areas only. TEMS CellPlanner Universal includes the highly advanced Geographical Information System (GIS). Digital mapping data is displayed by means of this system.

Network capacity planning can be based on either user-supplied traffic forecasts or network load Information extracted from live systems.

TEMS CellPlanner provides detailed frequency planning and interference analysis. The Intelligent Local Search Algorithm (ILSA) facilitates and helps automate frequency planning. ILSA Identifies and focuses on network areas where the interference is greatest. It also monitors its own progress, adapting its behavior in the course of planning. In addition, ILSA presents the action sequence of frequency planning in a clear, logical way, so the user can easily amend the settings and view the results.

TEMS CellPlanner can design neighbor cell relationships in a structured manner using propagation predictions. It can also define handover hysteresis margins. Enhancements have been made to the way in which 2G neighbors are displayed, added, and removed in the Site Database. A full range of neighbor-handling features is now incorporated, including the ability to isolate details of 2G neighbors, 3G neighbors, or both.

Location services have been added to TEMS CellPlanner to provide a means to locate a subscriber and/or mobile equipment. The location application derives the latitude and longitude of the mobile station from the network and uses Location Measurement Units (LMUs) to determine the location. The LMU is located with the base station. This is useful for measuring the signal of base stations, predicting received signal strength, and keeping track of base station clocks.

It is not a secret, that today humanity lives in a post-industrial informational age. Millions of photos and footages are made every day, thousands of mp3-s listened and TV-shows viewed. Today, storing and getting access to this media information isn't comfortable enough. People still need to mess with lots of different data cables to transfer media information from storage device to a player. DLNA smart home technology is called to solve this problem.

DLNA stands for Digital Living Network Alliance. It is a standard, which allows electronics and mobile devices work together seamlessly through a wired or wireless network to share digital content within a home environment. Building an additional home network is not needed. The technology uses Ethernet IP network or wireless Wi-Fi technology to connect devices.

All DLNA devices are divided into two classes: home network devices and mobile handheld devices.

Home network devices are: digital media server (DMS), digital media player (DMP) and digital media printer (DMP<sub>r</sub>). Digital media player can be a single device or a tandem of digital media renderer (DMR) and digital media controller (DMC). Digital media controller is a gadget, which finds content on digital media servers (DMS) and plays it on digital media renderers. DMP<sub>r</sub> can be used to print photos directly from the camera.

Mobile devices are: mobile digital media server (M-DMS), mobile digital media player (M-DMP), mobile digital media uploader/downloader (M-DMD/U) and mobile digital media controller (M-DMC).

For example, home PC or a laptop can be used as a digital media server, a cellphone as a mobile digital media server and a TV as a digital media player. If these devices are connected to each other in a local area network, it is possible to watch and listen any media information stored on a PC, laptop or phone on the TV screen just using its remote controller. Also, user's mp-3 player can work as a mobile digital media uploader and a photo or a video camera as a mobile digital media downloader. Making any additional cable connection or burning a CD is not needed.

Nowadays, there are more than 8000 DLNA-certified devices on the market. This includes TVs, DVD and Blu-ray players, games consoles, digital media players, photo frames, cameras, etc. So, building a smart home isn't a deep future stuff. It is already possible.

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## **CLOUD COMPUTING**

"Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing storage, memory, processing and bandwidth."

Key Characteristics of Cloud computing:

- On-demand self service

User can buy any amount of product on their own cloud services, the purchase and activation of services should not take much time.

- Ubiquitous network access

Cloudy solution should be available from any computer or phone anywhere in the world at any time.

- Metered use

Cloud product must accurately charge amount consumed at any one time services, but this is the amount of services must be paid.

- Elasticity

The user can order a very small number of services and use them long enough (for example, ten months) and order a large volume of services (ten times bigger) and use a shorter time period (month).

- Resource pooling

It does not matter what hardware node clouds now launched its virtual machine (or run to it by the application for the case of SaaS).

There are three Deployment models:

- Software as a Service(SaaS) is a software application delivery model by which an enterprise vendor develops a web-based software application, and then hosts and operates that application over the Internet for use by its customers. Customers do not need to buy software licenses or additional infrastructure equipment, and typically only pay monthly fees (also referred to as annuity payments) for using the software.

- Platform as a Service(PaaS) This is a complete platform – including application development, database development, storage and testing. Based on the time-sharing model, modern PaaS provides to create enterprised-class applications for use locally or on demand.

- Infrastructure as a Service(IaaS) is actually datacenter-as-a-service, or the ability to access computing resources. The difference with this approach versus mainstream cloud computing is that instead of using interface and a metered service, you're getting access to entire machine and a software on the machine.

Nowadays there are such Cloud Computing Platforms as Windows Azure, Amazon WebServices.

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## **ELEKTRONISCHER ABLASS DER STREIFEN**

Zur Zeit entwickelt sich der polygraphische Betrieb sehr schnell. Höchst fortschrittlich sind die Entdeckungen im Hardware-Bereich. Ich meine, dass die Programme für den elektronischen Ablass der Streifen manuell die neuesten und fortschrittlichen Entdeckungen sind. Der Ablass der Streifen ist möglich im Programm des manuellen Umbruchs aus PostScriptfiles der abgesonderten Streifen anhand der Programme wie Imposition oder Preps. Es gibt auch die Möglichkeit des Ablasses der Streifen in QuarkXPress mit Hilfe von INPosition.

Wenn man auf manuelle Montage verzichten wird, so hat man folgende Vorteile, und zwar: 1). Man spart das Geld für die manuelle Montage; 2). Garantierte Genauigkeit, das von

der Qualität der Zurückzieheneinrichtung abhängt; 3). Abbau der Zeit der Ausführung des Arbeitens in Druckerei.

Die Anwendung des Computersablasses der Streifen hat auch einige Nachteile: 1). Zusätzliche Kapitalanlagen durch die Anschaffung der neuen Programme; 2). Mehr Zeit für die Arbeit in Printenprozess; 3). Mehr Fehler, die nur nach dem Drucken der Fotoformen, sind zu entdecken.

Die Ausnutzung des elektronischen Ablasses der Streifen passt nicht für alle Herausgaben. Aber für periodische Herausgaben mit hartem graphischem Ausgangsplan und mit dem beschränkten Budget kann der Übergang auf den Auslauf der fertiggestellten Ablässe effektiver sein.

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## **HTML 5**

HTML is the Hyper Text Markup Language. Browser – a software application for retrieving, presenting, and traversing information resources on the World Wide Web. Markup language – set of markup tags, HTML uses markup tags to describe pages in WWW. Today standard of markup language in WWW since December 1997, is HTML 4(version 4.01 – since December 1999). Now we need new, faster and more useful solutions on WWW. Internet has changed since 1999 and now possibilities of HTML 4 standard aren't enough effective. And so as technologies evolves with humanity needs, HTML 4 evolves to HTML 5.

The primary one is consistent, defined error handling. It really helps to prevent incorrect display of HTML code in different browsers. The secondary goal of HTML 5 over HTML 4.01 is to develop the ability of the browser to be an application platform, with HTML, CSS, and JavaScript. Many elements have been added directly to the language that are currently (in HTML4) Flash or JS-based hacks, such as <canvas>, <video>, and <audio>.

For example, that is the way of <video> tag is used:

```
<video controls width="300" height="300" loop>
<source src="/html5/video.webm">
</video>
```

Attributes, which were used in the example:

src - the source URL of the video, loop - a boolean attribute that determines whether the video loops or not, width - the width in pixels of the element, height - the height in pixels of the element, controls - a boolean attribute that determines whether the video controls are shown or not.

Also in HTML 5 there are such useful things such as Local Storage (a JS-accessible browser-built-in SQL database, for storing information beyond what cookies can hold), new input types such as date for which the browser can expose easy user interface (so that we don't have to use our JS-based calendar date-pickers), and browser-supported form validation will make developing web applications much simpler for the developers, and make them much faster for the users (since many things will be supported natively, rather than hacked in with JavaScript). There are many other efforts taking place in HTML 5, such as better-defined semantic roles for existing elements and adding new elements with useful semantics – <article>, <section>, <header>, <aside>, and <nav> should replace the majority of <div>s used

on a web page, making your pages a bit more semantic, but more importantly, easier to read. No more scanning to see just what that random `</div>` is closing - instead you'll have an obvious `</header>`, or `</article>`, making the structure of a document much more intuitive. As the additions to all this possibilities there is also the new CSS version, CSS3, which gives more new possibilities for designers to beautify the functionality of web contents we want to manage.

The major ad networks and servers do not support insertion of ads in HTML5 players yet. But as we see HTML 5 has too many advantages over HTML 4, so the situation will change soon. HTML 5 provides useful additions to the language that will make building web based applications far more easily and efficiently, at the same time as making the code simpler.

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## **PRINTING AND THE ENVIRONMENT: NATURE-FRIENDLY DIGITAL PRINTING**

Traditional printing, which is not very eco-friendly, involves methods and materials, though was once acceptable, now considered harmful and undesirable. These include the choice of paper, ink and process for printing. As newer and eco friendly technologies become available such eco friendly digital printing, it ultimately replaces conventional methods.

Digital printing is continually evolving as with the advances in digital and printing technology, but one of the problems that the industry faces is the movement towards a paperless business environment.

Printing involves the use of heavy machinery, chemicals, and ink, which means that it is not an industry generally perceived as being environmentally friendly. These days, however, the evolving technology of large-scale digital printing is serving both the printer and the environment. Nowadays eco-friendly solutions make their way into the printing industry. It finally catches up with the rest of the world and goes green.

It should be noted that digital printing is more environmentally friendly than traditional printing methods, just because of their digital nature. As much of the work is done electronically, there is less environmental waste than there can otherwise be. Less paper and ink is wasted in the process of preparing and running the materials.

Modern models of digital printers are also developed with the environment in mind from the beginning, for example, you can use an LED light in its UV curing process. This has two fold effects on the process. First, it is more energy efficient than aged UV printers. They use approximately 50% less energy during the printing process. In addition, these printers cut down on the emission of short wave UV rays, which give off ozone, polluting the environment.

Another area of increasingly environmentally friendly technology for digital printers is in the ink and materials that they use to create their products. Nowadays ink is durable and made of environmentally friendly chemical formulas. This ink meets the highest industry standards for performance, durability, and safety since it contains no volatile organic compounds. Updated digital printers are concerned with reducing their carbon footprint.

Eco-friendly printing is the only way available to safeguard our surroundings from toxic chemical substances. Digital toners use 100 percent non toxic materials compared to 86 percent of biodegradable compounds found in soy ink. Digital toners used in eco-friendly digital printing are easily recycled and produces far less waste

In addition, eco-friendly printing is also more efficient and less expensive than its traditional predecessors. This is due to non use of printing plates that consume time, valuable energy resources and increase the carbon foot print of the product. To make a greener choice for a greener future conventional and traditional printing methods should be replaced by the more eco-friendly digital printing.

Modern trends in general printing and digital printing in particular do not focus only on the needs of the markets of printed products and improvement its quality, but also to improve the printing technology to reduce energy costs for manufacturing production and preservation of clean environment.

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## **INTRODUCTION OF SATELLITE NAVIGATION GLONASS: POSITION OF UKRAINE**

The system of satellite navigation the near future becomes an integral part of life of each developed state of the world. Today such systems were organically entered in economy of many countries, helping to solve various problems. It is necessary for system of satellite navigation:

1) Companions in an orbit (a covering of a terrestrial surface: they should be not less than 24 navigating companions). Orbital grouping GPS has 30 companions, in GLONASS - 23, today works 21 and is planned to launch into an orbit of 7 more companions.

2) the Land part. Reception, recognition of the given signals - the navigating equipment. In it GLONASS lags behind leaders in the market of the navigating equipment (the price, availability, service etc.).

At the heart of the navigating equipment - the receiver of a satellite signal (GPS the receiver, GLONASS / GPS the receiver etc.). The receiver of a satellite signal is the chip or a microcircuit which distinguishes a signal from the companion and gives out object coordinates.

The Ukrainian enterprises are one of founders of creation GLONASS, «Orizon - Navigation» (the Cherkassy region) is the enterprise created the first satellite navigating systems.

The main advantage of devices created by the enterprise is systemic. Navigating receivers can accept a signal simultaneously from 3 satellite systems. It is positive line, after all the device doesn't depend on number of companions, possesses stability to various hindrances. To Russia it is exported more than 80 % of production of the enterprise.

Cooperation to Ukraine and Russia will help to improve competitive element base. Production technologies of navigating devices GLONASS/ GPS more power-intensive, the sizes and the price for finished goods too differs from world, increased requirements to the aerial.

The price on GLONASS / GPS big prices GPS of analogs (accordingly \$60 and \$7-10).

Therefore the device will be subjects who don't demand tiny decisions. To compensate backlog from world technologies it is offered to improve the navigating device by change of payments on the network chip that is possible at cooperation of Ukraine and Russia.

It is necessary for Russia no more than 5 years to make GLONASS competitive. In the near future it is planned to enter the European system Galileo and Chinese Baydow" that

considerably will shake positions of Russia in the market. Therefore cooperation with Ukraine gives real chance of creation of the leader of navigation.

Creation GLONASS coincides with national interests of Ukraine, will help to leave on new level in the field of satellite navigation. For this purpose it is necessary to create joint an Ukrainian - the Russian enterprise.

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## **WIRELESS NETWORK SECURITY AND INTERWORKING**

Business networks today are evolving to support people who are on the move. Employees and employers, students and faculty, government agents and those they serve, sports fans and shoppers, all are mobile and many of them are "connected." Perhaps you have a mobile phone that you route instant messages to when you are away from your computer. This is the vision of mobility-an environment where people can take their connection to the network along with them on the road. There are many different infrastructures (wired LAN, service provider networks) that allow mobility like this to happen, but in a business environment the most important is the WLAN. In addition to the flexibility that WLANs offer, another important benefit is reduced costs. For example, with a wireless infrastructure already in place, savings are realized when moving a person within a building, reorganizing a lab, or moving to temporary locations or project sites. On average, the IT cost of moving an employee to a new location within a site is \$375 (US dollars). A variety of wireless technologies have been standardized and commercialized, but no single technology is considered the best because of different coverage and bandwidth limitations. Thus, interworking between heterogeneous wireless networks is extremely important for ubiquitous and high performance wireless communications. Security in interworking is a major challenge due to the vastly different security architectures used within each network. The goal of this article is two-fold. First, we provide a comprehensive discussion of security problems and current technologies in 3G and WLAN systems. Second, we provide introductory discussions about the security problems in interworking, the state of the art solutions, and open problems. Wireless communication technologies cover a whole spectrum from Wireless Personal Area Networks (WPAN), such as Bluetooth, to third generation cellular networks (3G), such as CDMA2000 and UMTS [1]. Despite such variety, opinions differ on which technology is optimal for satisfying all communication needs because of differing coverage and bandwidth limitations. For example, 3G networks provide widespread coverage with limited bandwidth (up to 2 Mbps). However, Wireless Local Area Networks (WLAN, IEEE Std. 802.11) provide high bandwidth (up to 54 Mbps) with relatively smaller coverage area. For ubiquitous and high performance wireless networking services, the interworking between wireless networks is extremely important. Most interworking studies have been dedicated to the integration of 3G and WLAN [2]. As our lives depend more and more on wireless communication, security has become a pivotal concern of service providers, engineers, and protocol designers who have learned that obscurity does not guarantee security and that ad-hoc remedies only complicate matters. Instead, good security is developed in an open environment with the collaboration of experts. However, increased interest in the interworking of cellphone and WLAN systems introduces new challenges. Centralized interworking authentication schemes have been proposed, but face scalability



issues. Context transfer schemes are designed to address these scalability issues and are a promising area of future research.

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## **SCHUTZ VON INFORMATIONEN DURCH COMPUTERTECHNOLOGIE**

Im Zeitalter der neuen Technologien, in denen Computer eine zunehmend starke Stellung in den einzelnen unseres Lebens hat, so dass es leicht ist, dabei körperliche Arbeit durch die Automatisierung zu erfüllen. Ja, aber für den ordnungsgemäßen Betrieb dieser Geräte müssen hochwertige Software und Informationsquellen, die in den meisten Fällen existieren, gebaut werden –in der Festplatte (HDD).Seine Kapazität ist abhängig von der Größe des Speichers, und heute gibt es Festplatten, viele Bibliotheken und Video-Sammlung können sehr viel Information enthalten.

Jetzt arbeiten immer mehr PC-Anwender an den Ressourcen des World Wide Web.Aber um sich vor Viren und Schadprogrammen zu schützen, da Sie sonst Gefahr haben, nicht nur alles, was Sie auf Ihrer Festplatte zu verlieren aber auch die Möglichkeit haben, Ihren Computer selber zu schaden.

Neben Malware existiert Software, die unschätzbare Vorteile den PC-Besitzern bietet, wie ihre Verteidiger und defensive Chancen. Ja, die Vernichtung von Informationen von der Festplatte kann auch ohne Verschulden von Malware auftreten, aber nur durch Fehler des Besitzers. In solchem Fall gibt es Programme, mit denen Sie sich Daten auch nach ihrer vollständigen Löschung von Festplatten wiederherstellen lassen.In der Regel können die Informationen, die versehentlich gelöscht wurden oder absichtlich auf der Festplatte gespeichert, das, was Sie richtig aufeinander abgestimmt haben, kann gespeichert werden.

Eigentlich werden Sie mit seinem Computer und mit Hilfe der nützlichen Programmen selbst dafür sorgen, eine vollständige Sicherheit und Löschen von Informationen zu gewährleisten. Jahr für Jahr sind die Computer-Technologien die Verbesserung und Bereicherung unseres geistigen Ebene.

Wir leben in einer Zeit, wenn der PC ein wirklich persönliches wird. Nun ist es nicht ungewöhnlich, wenn keiner einen Computer für die ganze Familie und einen für jedes ihrer Mitglieder kaufen wird. Und eine Menge der Menschen trägt zu diesem Prozess, der immer mächtiger wird, aber zur gleichen Zeit und erschwinglicher Laptops die Mobile- Computer, so dass nicht nur größere Freiheit bietet sondern auch genug für die meisten Gelegenheitsbenutzerressourcen.

Ich muss sagen, dass in der heutigen Zeit mehrere Dutzend Hersteller eine große Anzahl von Notebook-Modellen auf unterschiedlichen Ebenen und Preisklassen anbieten. Jetzt können Sie Laptops, die mit dem komplexen ressourcenintensiven Software (Software-Engineering, Grafik und Musik-Editoren, etc.) und Laptops Arbeits-, Betriebsressourcen mit einem Minimum von Problemen.

Data Loss Prevention system is designed to protect information assets with minimal interference in business processes. It provides new insights into how data is used, and enforces protective controls to prevent unwanted incidents. It's not perfect, and no technology can completely eliminate data loss, but in combination with appropriate security processes DLP can reduce risk, improve data management practices, and even lower certain compliance costs.

DLP suites combine an array of technologies to protect data throughout its lifecycle. They accomplish this by “understanding” both the content and context of data, matching them against central policies, and enforcing business rules. At the core, DLP uses content analysis to peer inside files and network communications to identify sensitive content. DLP actually recognizes the data it is looking at, and matches it to policies set for acceptable use of the content. In practice user defines what data to protect, then uses DLP to automatically locate where it's stored, where it's being communicated, and where it's being moved. The core components of a DLP solution: centralized management, identification of defined data, monitoring of usage, and protection from policy violations.

Content analysis is the distinguishing and most important feature of Data Loss Prevention. It's how the DLP solution identifies sensitive data, which it then matches against policies for enforcement. Two steps occur in content analysis — breaking apart files to get to the data, and then the analysis itself. There are six main content analysis techniques in use: Rules/Expressions, Partial Document Matching, Database Matching, Statistical, Conceptual, Categories.

Categorization of DLP architectures based on the place where they protect data: data-in-motion for email and other network communications, data-at-rest for stored data, and data-in-use as for interactions with the data on computers, such as copying it to USB drives. Behind all this is the central management server where administrator defines policies and manages incidents.

The central management server is the main part of the DLP solution and in many cases it performs some or most of the monitoring and protection functions. Since DLP is focused on a business problem as opposed to a technical problem it's important for DLP systems to support both non-technical and technical users. Also, central management server has features such as robust reporting; integration with user directories to tie policies to users and groups; hierarchical management for multiple systems in large environments; and standard performance, reliability, and management features common to most security tools.

Data Loss Prevention is a tool for protecting data. DLP identifies sensitive data, monitors its use, and protects it from abuse. DLP tools accomplish this by monitoring your network, scanning your storage infrastructure, and tracking data use on endpoints such as laptops and desktops through deep content analysis, which allows you to define what data to protect and how to protect it.

## **CLOUD COMPUTING - A NEW ERA IN IT**

During the past 40 years, information technology has undergone many revolutions in how applications and data have been delivered to users. Mainframes provided a centralized computation facility where end users consumed resources on a shared basis. Client-server architectures offered flexibility and lowered computing costs while bringing more power to the desktop. Mobile computing introduced the notion of anytime, anywhere application access from a laptop or handheld device. Now cloud computing offers a new approach that will enable you to deliver IT services on demand.

### **Definition of Cloud Computing:**

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

### **Why Cloud Computing? Why Now?**

Business stakeholder demands on IT are increasing. Every business decision impacts IT, and accelerating market forces reward first movers. Yet most enterprise applications and services are built on top of tightly coupled technology stacks that are challenging to change and costly to manage. Provisioning a new email server or business intelligence engine, for example, can require months of waiting just for hardware purchases and system image configurations. Caught between shrinking resources and growing business needs, organizations are looking to cloud computing to provide a more efficient, flexible and cost-effective model for computing—one that allows IT to operate much more efficiently and respond faster to business opportunities. The goal is to enable IT as a Service, and cloud computing provides the technical architecture to deliver it.

## **ANALYSIS AND OPERATING PRINCIPLE OF SEARCHING SYSTEMS**

The rapid development of the Internet in the last few years has actually transformed the global information network into a giant "dump" of information. Originally, the network had no structuring data presented therein. In order to guide such volumes of information directories www servers and search engines were created. A catalog is a collection of links to web-resources for different groups (education, programming, weather, etc.). Search engines allows user to find the information they need by a particular keyword or set of words.

Any search engine consists of two parts: the user interface and a special program established by the search engine, which is getting over on the page to page on the links, indexes all the textual information in its database. Typically, such a program is given a page with many links to various directories of resources. The program, going on line, links gaining an increasing amount of information. When a user enters into the system any word to find its entry is sought in the database on the server and the user is given a set of links on those servers on which a given word occurs.

As servers are changing permanently, program has to revolve to previously indexed servers for updating the information. Otherwise half of the links that searching machine has given out in response, will be inaccessible in two or three month. Different search engines update period can vary greatly, often the less indexed information system contains, the more it returns to each of the pages to check for changes.

Users should keep in mind that the ability to build a query properly can greatly facilitate the sorting of search results for relevance, when they are working with search engines.

Each search engine has its own specific features, its own advantages and disadvantages, strengths and weaknesses. The capabilities of traditional systems have been largely exhausted and inadequate for working with data sets of large volumes available today on the Internet. This led to need of searching solution that would require a much greater complexity and functionality as well as research and development, and at the stage of writing and providing the user with accurate and easy access of information.

With search engines that support Boolean operators and parentheses, a technique traditionally used by librarians can be applied. A user who is looking for documents that cover several topics or facets may want to describe each of them by a disjunction of characteristic words, such as vehicles OR cars OR automobiles. A faceted query is a conjunction of such facets; e.g. a query such as (electronic OR computerized OR DRE) AND (voting OR elections OR election OR balloting OR electoral) is likely to find documents about electronic voting even if they omit one of the words "electronic" and "voting", or even both.

Most Web search engines are commercial ventures supported by advertising revenue and, as a result, some employ the practice of allowing advertisers to pay money to have their listings ranked higher in search results. Those search engines which do not accept money for their search engine results make money by running search related ads alongside the regular search engine results. The search engines make money every time someone clicks on one of these ads.

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## **NEURAL NETWORKS**

An artificial neural network, usually called "neural network", is a mathematical model or computational model that is inspired by the structure and/or functional aspects of biological neural networks. It consists of an interconnected group of artificial neurons and processes information using a connectionist approach to computation. In most cases neural network is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase. Modern neural networks are non-linear statistical data modeling tools.

The utility of artificial neural network models lies in the fact that they can be used to infer a function from observations. This is particularly useful in applications where the complexity of the data or task makes the design of such a function by hand impractical.

The tasks to which artificial neural networks are applied tend to fall within the following broad categories: function approximation, or regression analysis, including time series prediction, fitness approximation and modeling; classification, including pattern and

sequence recognition, novelty detection and sequential decision making; data processing, including filtering, clustering, blind source separation and compression; robotics, including directing manipulators, computer numerical control.

Application areas include system identification and control (vehicle control, process control), quantum chemistry, game-playing and decision making (backgammon, chess, racing), pattern recognition (radar systems, face identification, object recognition and more), sequence recognition (gesture, speech, handwritten text recognition), medical diagnosis, financial applications (automated trading systems), data mining (or knowledge discovery in databases), visualization and e-mail spam filtering.

Many models are used in the field defined at different levels of abstraction and modeling different aspects of neural systems. They range from models of the short-term behavior of individual neurons, models of how the dynamics of neural circuitry arise from interactions between individual neurons and finally to models of how behavior can arise from abstract neural modules that represent complete subsystems. These include models of long-term and short-term plasticity, of neural systems and their relations to learning and memory from the individual neuron to the system level.

While initially research had been concerned mostly with the electrical characteristics of neurons, a particularly important part of the investigation in recent years has been the exploration of the role of neuromodulators such as dopamine, acetylcholine, and serotonin on behavior and learning. Biophysical models have been important in understanding mechanisms for synaptic plasticity, and have had applications in both computer science and neuroscience. Research is ongoing in understanding the computational algorithms used in the brain, with some recent biological evidence for radial basis networks and neural backpropagation as mechanisms for processing data. Computational devices have been created in CMOS for both biophysical simulation and neuromorphic computing. More recent efforts show promise for creating nanodevices for very large scale principal components analyses and convolution.

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## **CUTTING-EDGE RIA TECHNOLOGIES**

A RIA (Rich Internet Application) is a web application that behaves like a desktop application. Before RIAs began popping up, most web applications were composed of static pages. Unlike desktop applications, any interaction with a web page usually resulted in reloading a whole new page. Desktop applications, on the other hand, had much better user interactivity because all of the processing was being done natively on the user's machine, resulting in a more seamless user experience.

Desktop applications have smoother user interactivity, but require distribution and dealing with software updates when the software has shipped.

Web applications, on the other hand, are easily accessible from the web, freeing it from the problems related to software distribution and updates, but were very lacking in user interactivity. RIAs are the best of both worlds, and distributed through the web, and have very rich user interactivity.

Among these technologies are frameworks that help developers build and deploy rich internet applications, such as JavaScript libraries, ICEfaces, Adobe Flash, Microsoft Silverlight, and HTML5.

JavaScript libraries were one of the first technologies to really help deploy slick and interactive rich web apps. They provided a framework for an RIA application that leveraged client-side scripting to handle front-end interface functions. They are basically JavaScript files that comprise of a collection of useful, cross-browser-tested functions for doing things with Ajax and dealing with common user interactions like hiding and showing content based on a user-driven event. Some of the most popular ones today are jQuery (especially with jQuery UI), MooTools, YUI (Yahoo! User Interface library), and ExtJS.

ICEfaces extend the standard JavaServer Faces (JSF) framework and is intended to simplify the programmer's workflow by removing JavaScript from the equation. In other words, ICEfaces handle all of the JavaScript/Ajax for your web application via Java APIs. This greatly simplifies the task of creating rich internet applications by removing some of the complexities introduced by building custom JavaScript functions.

Adobe Flash Builder so exciting is its cross-platform and cross-browser nature, allowing it to run exactly the same way across all operating systems and all browsers. Comparing it to JavaScript, where browsers have varying JavaScript engines that handle and process your code, Adobe Flash has one engine that your users install via the Adobe Flash browser plugin.

Silverlight is powerful Microsoft's version of Adobe Flex, which has more extended facilities but doesn't seem to be catching up to Adobe Flash in terms of popularity.

HTML5 is the latest development in the RIA movement. HTML5 is, in essence, the result of merging the best of HTML4, JavaScript, CSS, JavaScript libraries, and Flash into a single specification that leverage the API model. HTML5 is an open technology, which means there isn't going to be a single governing body like Adobe for Flash or Microsoft for Silverlight.

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## **SEMANTIC NETWORKS**

A semantic network is a network which represents semantic relations among concepts. This is often used as a form of knowledge representation. It is a directed or undirected graph consisting of vertices, which represent concepts, and edges. "Semantic Nets" were first invented for computers by Richard H. Richens of the Cambridge Language Research Unit in 1956 as an "interlingua" for machine translation of natural languages.

In the 1960s to 1980s the idea of a semantic link was developed within hypertext systems as the most basic unit, or edge, in a semantic network. These ideas were extremely influential, and there have been many attempts to add typed link semantics to HTML and XML. In the semantic network of the top performing the role of the concept knowledge base, and the arc (and directed) set the ratio between them. Thus, semantic network reflects the semantics of a domain in the form of concepts and relations between them. Never be confused notion of "semantic network" and "semantic web". This inconsistency arises precisely because

of inaccurate translation. Although these concepts are not equivalent, however, they are associated. Thus, semantic network is one way of knowledge representation.

For all semantic networks are fairly split on the number and types of relations.

By the number of types of networks may be heterogeneous and homogeneous. Homogeneous networks have only one type of relationship (arrows), for example, this is the classification of biological species (with the only relation AKO). In heterogeneous networks of two types of relations. Classic illustrations of this model of knowledge representation represent just such a network. Non-uniform network representing more interest for practical purposes, but also greater complexity of research.

They are characterized by a network of binary relationships (which connect exactly two concepts). Binary relations, indeed, are simple and easy to look at the graph as an arrow between two concepts. In addition, they play an important role in mathematics. This difficulty - how to display a similar relationship on a graph, not to get confused, when we have more than two relations. Conceptual graphs remove this complication, representing each relationship as a separate unit.

In conceptual graphs there are other modifications of semantic networks, this is another basis for classification.

Trying to create a semantic network based on the World Wide Web called the semantic web. This concept implies the use of language RDF (markup language based on XML) and designed to add a link to the Internet (URL) a sense understandable computer systems. It will transform the Internet for distributed knowledge base of global scale.

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## **SATELLITE TELEVISION**

In most cases, satellite TV has proven itself to be worthy for the customers. It gives them a high quality experience like no other, and it's getting better and better every year. As a result, it makes you feel comfortable in using them for a long time. Do you think that satellite TV providers will give you a real comfortable experience? What benefits and features do they have in order to make your life comfortable than ever? First of all, satellite television is one of the best entertainment sources today. It gives you something that is in high quality, and it's difficult for the others to surpass it.

Satellite television has lots of things for you to check them out, and to experience something comfortable like no other. Let's start with the high-definition and small-definition feature of any satellite television provider. High-definition television (HDTV) is the highest quality that you will obtain in any satellite provider. You will experience something new on this feature, as the people and objects (except cartoons and animations) look realistic than ever. On the other hand, small-definition television (SDTV) is only secondary to HDTV.

In most cases, SDTV is better than any analog or antenna TV sets with poor quality reception. With HDTV and SDTV, it's good enough to make you feel comfortable in watching TV shows all along. Let's try to compare between a satellite TV and an analog TV for you to know which one's better. For example, if a TV show is all about a romantic date between a guy and his girlfriend, we will put two TV's in place with the same show. It's easy to compare

which one looks better for you to watch. It's quite sure that 100% of the viewers are picking satellite television as the best in quality.

There is no way that you might feel comfortable about an analog TV. If you are sticking to an analog TV, you might be tempted to subscribe with a local satellite provider that gives you high quality like no other. Analog TV is not good enough to be a perfect entertainment source for the customer, because it has a lot of limits for them. The first limit is the number of channels. These channels are more on variety types, and it ranges between 10-20 channels at a time. But if you subscribe with any satellite television provider, it gives you up to 200 channels to enjoy.

The second limit of an analog TV is the reception quality. If in case there's a bad weather, the reception of your analog TV is interrupted and gives you a low quality experience. But if you do that with satellite TV, there is no problem when it comes to bad weather. No matter how bad is the weather, it will not interrupt the quality of your reception. However, it may be interrupted during the maintenance period. This is good enough for a subscriber to feel comfortable in watching TV shows, especially for stressful people. If you're looking for something that makes you feel comfortable at home, satellite TV will provide it for you. Not only it gives you a comfortable experience, but it also provides non-stop entertainment at home.

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## **APPLICATION OF GEOGRAPHIC INFORMATION TECHNOLOGIES IN DAY-TO-DAY LIFE**

Fifty years ago, most people had a different relationship with geographic information. That relationship was based almost entirely on maps. A map was something that fell out of the middle of the latest issue of National Geographic magazine or lived in the car's glove box (if you managed to refold it) or was tacked up on a classroom wall. In the intervening decades—thanks to Geographic Information System (GIS)—the use of geographic information has expanded exponentially. Now it so permeates our world that its use has become remarkably integrated into everyday life. Geospatial technologies are working behind the scenes improving the generation and distribution of energy, the production of food, and the safeguarding of water supplies.

The use of GIS is rapidly spreading across the world as one of the most important technologies that helps nations address their most serious health goals including reducing disparity in the medical services available, improving access to services, and preventing the spread of disease. The strength of modern GIS technology extends well beyond geographically relevant data analysis and powerful data visualization. It excels as a medium that helps inform, organize, and deliver health and human services. GIS supports every Web-based service locator, every directions-finding Web site, and every consumer-facing information and referral service sponsored by health organizations.

As nations strive to protect their citizens from the threat of infectious diseases, such as legionella, dengue fever, West Nile virus, tuberculosis, or avian influenza, GIS has become an important technology for adding intelligence to existing disease surveillance systems at the local, regional, and national levels. GIS technology's ability to author, publish, and share



critical information about the spatial dynamics of disease makes it, without exception, the technology of choice for accelerating the detection and identification of disease clusters. GIS technology's capacity to reach beyond geopolitical boundaries makes it highly desirable in public health emergencies and responses.

Today, more than 90 national health ministries located across every continent license some type of ESRI technology. ESRI software is being deployed in the form of specialty epidemiological software distributed at low or no cost to health professionals through organizations such as the World Health Organization, Pan-American Health Organization, and the U.S. Centers for Disease Control and Prevention.

As GIS technology continues to enjoy wider adoption in health and human service organizations across all types of government and private health care organizations, knowledge about our communities – especially how our local environments impact our personal health – will command greater attention by community leaders everywhere. The ability to respond to emergencies and prepare citizens for disasters such as pandemics cannot be overlooked or under-resourced in regard to information systems.

Global health begins at home. The obligation of nations to help citizens have a safe, healthy passage through life is neither a small nor simple matter.

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## **CONTINUOUS ACQUISITION AND LIFE CYCLE SUPPORT**

CALS-technologies (English Continuous Acquisition and Life cycle Support - continuous information support the supply and life cycle) - a modern approach to designing and manufacturing high technology products, consisting in the use of computer technology and modern information technologies at all stages of product life cycle, providing uniform methods of process management and collaboration of all participants in this series: products customers, suppliers / producers, operating and maintenance personnel, implemented in accordance with the requirements of international standards governing the rules of this interaction primarily through electronic data interchange. FPI (informational support processes of product life cycle) - Russian analog of CALS. Application of CALS-technologies can significantly reduce the amount of design work as well as descriptions of many parts of equipment, machinery and systems designed previously stored in a standardized data formats of network servers available to any user of technology CALS. Greatly facilitates the solution of problems of maintainability, integration of products in different kinds of systems and environments, adapting to the changing conditions of operation, the specialization of design organizations, etc. It is assumed that the market success of complex technical products would be unthinkable outside technology CALS. Development of CALS-technologies should lead to the emergence of so-called virtual enterprises, in which the process of creating specifications for information technology equipment and software controlled, sufficient for the manufacture of products may be distributed in time and space among the many organizational and self-contained project studios. Among the obvious achievements of CALS-technologies should be noted easy dissemination of advanced design solutions, the ability to play multiple parts of the project in new developments, etc. Building open distributed automation systems design and management in industry is the foundation of modern CALS-technology. The main problem of their

construction - ensuring a consistent description and interpretation of data, regardless of location and time of receipt in the overall system with a scale up to global. Structure design, technological and operational documentation, languages, its representation must be standardized. Then it becomes a real successful work on a common project of different groups, separated in time and space and using different CAD / CAM / CAE-system. The same design documentation can be used repeatedly in different projects, and the same technological documentation - to adapt to different working conditions that can significantly shorten and cheapen the overall design cycle and manufacturing. In addition, it simplifies the operation of systems. To ensure the integration of information using CALS standards IGES and STEP as the data formats. In CALS also includes standards for electronic data interchange, electronic technical documentation and manuals for process improvement. In recent years, work to establish national standards for CALS-carried out in Russia under the auspices of the Federal Technical Committee of the Russian Federation. For this purpose, a technical committee TK43 «CALS-technologies", which was developed by a number of series of standards ISO 10303, which are authentic translations of the relevant international standards (STEP). Department of Defense has announced plans to create a global automated system for electronic description of all phases of design, manufacture and operation of products for military use.

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### **A FACTORY ON YOUR DESK**

3D printing is a form of additive manufacturing technology where a three dimensional object is created by laying down successive layers of material. Do not be confused with printing on 3d shapes – that's different process.

A 3D printer works by taking a 3D computer file and using and making a series of cross-sectional slices. Each slice is then printed one on top of the other to create the 3D object.

Getting idea about 3D scanning. The purpose of a 3D scanner is usually to create a point cloud of geometric samples on the surface of the subject.

3D scanners are very analogous to cameras. 3D scanners collect distance information about surfaces within its field of view. The “picture” produced by a 3D scanner describes the distance to a surface at each point in the picture.

Technologies to do 3D printing:

Inkjet printing system - The printer creates the model one layer at a time by spreading a layer of powder (plaster, or resins) and inkjet printing a binder in the cross-section of the part. The process is repeated until every layer is printed.

DLP (Digital Light Processing) - a vat of liquid polymer is exposed to light from a DLP projector under safelight conditions. The exposed liquid polymer hardens. The liquid polymer is then drained from the vat, leaving the solid model.

FDM (Fused deposition modeling) - the model or part is produced by extruding small beads of thermoplastic material to form layers as the material hardens immediately after extrusion from the nozzle.

SLS (Selective laser sintering) and DMLS (Direct Metal Laser Sintering) - the unfused media serves to support overhangs and thin walls in the part being produced, reducing the need

for auxiliary temporary supports for the workpiece. Typically a laser is used to sinter the media and form the solid.

3D-microfabrication - the desired 3D object is traced out in a block of gel by a focused laser. The gel is cured to a solid only in the places where the laser was focused, due to the nonlinear nature of photoexcitation, and then the remaining gel is washed away. Feature sizes of under 100 nm are easily produced, as well as complex structures such as moving and interlocked parts.

Advantages of 3D printing : speed, low cost, and ease-of-use, ecological benefits - no toxic chemicals is used against old stereolithography methods.

Scope of use: design visualization, prototyping/CAD, metal casting, architecture, education, geospatial, biotechnology (Organ printing, bio-printing, and computer-aided tissue engineering), paleontology, archaeology, artistic expression, computer games.

Home 3D Printers. There are lots of projects and companies involved into 3D printing. For instance, 3D Systems, Desktop Factory, Z Corporation , Figureprints, Landprint – where you can buy some equipment for printing or get some services.

There's also great possibility to create such device by yourself – RepRap, Fab@Home and Thingiverse - open-source projects allows you to become a member of "fabbers" (desktop fabricators, ie. owner/operators of home 3D printers) community.

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## **APPLICATION OF NEURAL NETWORKS AND THEIR FUTURE**

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurons) working in unison to solve specific problems.

ANNs, like people, learn by example. There are three major learning paradigms, each corresponding to a particular abstract learning task. These are supervised learning, unsupervised learning and reinforcement learning. Usually any given type of network architecture can be employed in any of those tasks.

An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurons. This is true of ANNs as well.

There are a few architectures of neural networks: feed-forward ANNs (allow signals to travel one way only; from input to output) and feedback networks (signals can travel in both directions by introducing loops in the network).

Neural networks have found a wide range of applications, the majority of which are associated with problems in pattern recognition and control theory. Here we give a small selection of examples, focusing on applications in routine use.

The problem of recognizing handwritten characters is a challenging one that has been widely studied as a prototypical example of pattern recognition. Some of the most successful approaches to this problem are based on neural network techniques and have resulted in several commercial applications. Mass screening of medical images is another area in which neural

networks have been widely explored, where they form the basis for one of the leading systems for semi-automatic interpretation of cervical smears. As a third example of pattern recognition we mention the problem of verifying handwritten signatures, based on the dynamics of the signature captured during the signing process, where the leading approach to this problem is again based on neural networks.

Neural networks have also been applied to the real-time control of the mirror segments in adaptive optics telescopes, used to cancel distortions due to atmospheric turbulence.

Neural networks are increasingly being used in real-world business applications and, in some cases, such as fraud detection, they have already become the method of choice. Their use for risk assessment is also growing and they have been employed to visualise complex databases for marketing segmentation. This boom in applications covers a wide range of business interests — from finance management, through forecasting, to production. The combination of statistical, neural and fuzzy methods now enables direct quantitative studies to be carried out without the need for rocket-science expertise.

The prospects for neural networks seem excellent, giving the increasing sophistication of the underlying theory, the increasing range of applicability of the techniques, and the growing scale of the applications that are being undertaken. The interdisciplinary nature of research in the field seems certain to persist and to bring new vigor into allied fields.

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## **FUTUREGRID. CYBERINFRASTRUCTURE FOR COMPUTATIONAL RESEARCH**

The FutureGrid Project provides a capability that makes it possible for researchers to tackle complex research challenges in computer science related to the use and security of grids and clouds. These include topics ranging from authentication, authorization, scheduling, virtualization, middleware design, interface design and cybersecurity, to the optimization of grid-enabled and cloud-enabled computational schemes for researchers in astronomy, chemistry, biology, engineering, atmospheric science and epidemiology. The project team will provide a significant new experimental computing grid and cloud test-bed, named FutureGrid, to the research community, together with user support for third-party researchers conducting experiments on FutureGrid.

The test-bed will make it possible for researchers to conduct experiments by submitting an experiment plan that is then executed via a sophisticated workflow engine, preserving the provenance and state information necessary to allow reproducibility.

The test-bed includes a geographically distributed set of heterogeneous computing systems, a data management system that will hold both metadata and a growing library of software images, and a dedicated network allowing isolatable, secure experiments. The test-bed will support virtual machine-based environments, as well as native operating systems for experiments aimed at minimizing overhead and maximizing performance. The project partners will integrate existing open-source software packages to create an easy-to-use software environment that supports the instantiation, execution and recording of grid and cloud computing experiments.

One of the goals of the project is to understand the behavior and utility of cloud computing approaches. Researchers will be able to measure the overhead of cloud technology

by requesting linked experiments on both virtual and bare-metal systems. FutureGrid will enable US scientists to develop and test new approaches to parallel, grid and cloud computing, and compare and collaborate with international efforts in this area. The FutureGrid project will provide an experimental platform that accommodates batch, grid and cloud computing, allowing researchers to attack a range of research questions associated with optimizing, integrating and scheduling the different service models. The FutureGrid also provides a test-bed for middleware development and, because of its private network, allows middleware researchers to do controlled experiments under different network conditions and to test approaches to middleware that include direct interaction with the network control layer. Another component of the project is the development of benchmarks appropriate for grid computing, including workflow-based benchmarks derived from applications in astronomy, bioinformatics, seismology and physics.

The FutureGrid will form part of NSF's TeraGrid high-performance cyberinfrastructure. It will increase the capability of the TeraGrid to support innovative computer science research requiring access to lower levels of the grid software stack, the networking software stack, and to virtualization and workflow orchestration tools.

The FutureGrid project leverages the fruits of several software development projects funded by the National Science Foundation and the Department of Energy.

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## **BLUE BRAIN PROJECT**

The Blue Brain Project is an attempt to create a synthetic brain by reverse-engineering the mammalian brain down to the molecular level. The aim of the project, founded in May 2005 by the Brain and Mind Institute of the École Polytechnique in Lausanne, Switzerland, is to study the brain's architectural and functional principles. The project is expected to provide answers to a number of fundamental questions, ranging from the emergence of biological intelligence to the evolution of consciousness. Using a Blue Gene supercomputer running Michael Hines's NEURON software, the simulation does not consist simply of an artificial neural network, but involves a biologically realistic model of neurons.

The initial goal of the project, completed in December 2006, was the simulation of a rat neocortical column, which can be considered the smallest functional unit of the neocortex (the part of the brain thought to be responsible for higher functions such as conscious thought). Such a column is about 2 mm tall, has a diameter of 0.5 mm and contains about 60,000 neurons in humans; rat neocortical columns are very similar in structure but contain only 10,000 neurons (and 108 synapses). A longer term goal is to build a detailed, functional simulation of the physiological processes in the human brain: "It is not impossible to build a human brain and we can do it in 10 years," Henry Markram, director of the Blue Brain Project said in 2009 at the TED conference in Oxford. In a BBC World Service interview he said: "If we build it correctly it should speak and have an intelligence and behave very much as a human does." The project is currently pursuing two separate goals: 1) construction of a simulation on the molecular level, which is desirable since it allows studying the effects of gene expression; 2) simplification of the column simulation to allow for parallel simulation of large numbers of connected columns,

with the ultimate goal of simulating a whole neocortex (which in humans consists of about 1 million cortical columns).

There are a number of sub-projects, including the Cajal Blue Brain, coordinated by the Supercomputing and Visualization Center of Madrid (CeSViMa), and others run by universities and independent laboratories in the UK, US, and Israel. The Cajal Blue Brain is coordinated by the Technical University of Madrid and uses the facilities of the Supercomputing and Visualization Center of Madrid and its supercomputer Magerit. The Cajal Institute also participates in this collaboration. The main lines of research currently being pursued at Cajal Blue Brain include neurological experimentation and computer simulations. Nanotechnology, in the form of a newly designed brain microscope, plays an important role in its research plans.

In November 2007, the project reported the end of the first phase, delivering a data-driven process for creating, validating, and researching the neocortical column. The project is now striving to simplify the simulation of the column, in order to allow the parallel simulation of multiple connected columns. If this strategy will be successful, the final objective will be to simulate a whole human neocortex.

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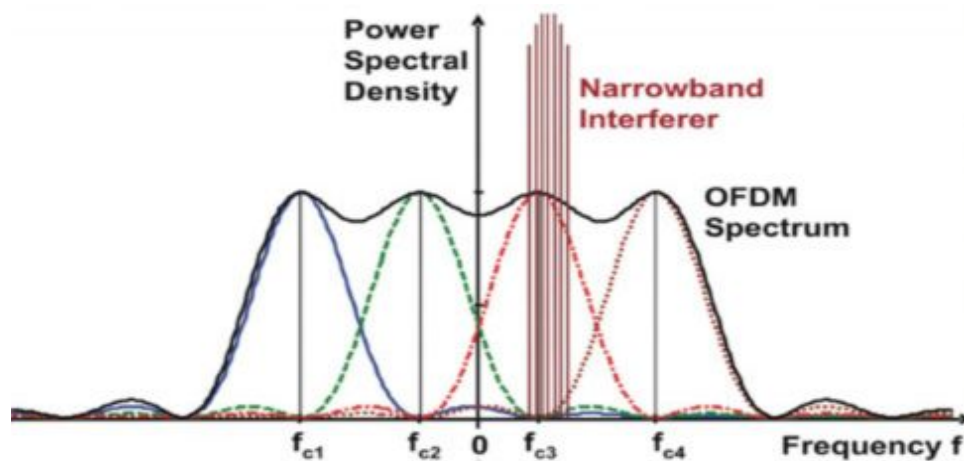
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## **RADIO LINK RESOURCE ALLOCATION ON OFDMA DOWNLINK**

In cellular systems, service providers are interested in offering a given quality of service (QoS) to all users regardless of their locations in the cell. This leads to the challenging problem of resource allocation under fairness constraints. In this paper, we focus on the case of an OFDMA (Orthogonal Frequency-Division Multiple Access) downlink. OFDMA is a multi-user version of the popular Orthogonal frequency-division multiplexing (OFDM) digital modulation scheme.

OFDM is a method that allows to transmit high data rates over extremely hostile channels at a comparable low complexity. OFDM spread spectrum technique distributes the data over a large number of carriers that are spaced apart at precise frequencies. This spacing provides the “orthogonality” in this technique which prevents the demodulators from seeing frequencies other than their own. The benefits of OFDM are high spectral efficiency, resiliency to RF interference, and lower multi-path distortion. This is useful because in a typical terrestrial broadcasting scenario there are multi path-channels.

In OFDM, subcarriers overlap. They are orthogonal because the peak of one subcarrier occurs when other subcarriers are at zero. This is achieved by realizing all the subcarriers together using Inverse Fast Fourier Transform (IFFT). The demodulator at the receiver parallel channels from an FFT block. Note that each subcarrier can still be modulated independently. This orthogonality is represented in Figure 1.



*Figure 1. OFDM spectrum*

We address the problem of resource allocation on the downlink of an OFDMA single-cell system under fairness constraints with limited channel state information (CSI). Target QoS corresponds to a minimum user data rate, a target bit-error rate and a maximum BER-outage probability. The channel model includes path-loss, shadowing, and fading. The only available CSI is the channel average gain of each user. This partial CSI defines a shadowed path-loss that yields a modified user distribution. Resource allocation is based on the shadowed user distribution that we characterize analytically. Thus, under the target QoS, we provide the optimal resource allocation that maximizes the user rate. Compared to full-CSI-based allocation schemes, our solution offers a significant complexity and feedback reduction.

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## **APPLIANCE OF MODERN INFORMATION TECHNOLOGIES FOR IMPROVING THE EFFICIENCY OF THE COMPANIES**

The effectiveness of the analyst, accountant and manager in the company is significantly enhanced by informatization and automation workflow tools that allow effectively accumulate the appropriate databases on the effects of economic activities and use them for forming, editing and printing the output documents, reports, and provide information on the effectiveness of the institution.

There are many inconsistencies and gaps in the creation of the company informatization and automation departments, that impede the development of the information network and reduce the effectiveness of new and advanced information technologies. Among them, one should emphasize the next ones:

- using of various software tools both new and old, considerably complicates the maintenance of information systems and reduces the implementation effect;
- eliminating of various software individual defects may become an everyday problem that requires creating the whole information network' state monitoring tools;
- lack of the regulatory framework for the automated accounting system regulation in the Ukrainian market.

The solution of these problems may be a creation of specialized information decision support system (IDSS) that would provide to comprehensively manage all aspects of business.

DSS is a computer information system that aids the user in any decision-making process. DSS helps in solving modeling, forecasting problems, optimal selected processes control problems using mathematical statistics, operation research and decision-making theory methods. In addition, they should contain a set of criteria for the best decision-making.

Within research the dental clinic management DSS is being developed. The main aim of this system creating is the optimization and systematization of the clinic, improving of the customer service and effective institution management strategy forming.

The DSS application will allow:

- to analyze the demand for all services provided by clinic;
- to organize and keep records of material supply;
- to develop materials procurement planning methods, based on analysis of different services demands;
- to plan and keep medical staff work records;
- to organize and keep track of all customer services with organizing the storing of data and easy access to all necessary information and its analysis about patients.

The system will provide cooperation and automation of operation of these clinic activities: clinic management, receptionist work, warehouse, accounting and will also provide physicians instant access to the patient and dental services information.

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## **SOLID STATE IMAGE SENSORS**

Solid State or electronic image sensors consist of array(s) of photodiodes that produce an electrical signal in response to light illumination. Such image sensors can be divided into two broad categories, CCD (charge-coupled devices) and CMOS (Complementary Metal Oxide Semiconductor), depending on how the signal is read out from the photodiodes.

Typically, CCD sensors use repeated lateral transfer of charge in an analog shift register. Photo-generated electrons or holes are read out after they are shifted in appropriate positions. CCD sensors have disadvantages, for example, to perform charge shifting with high fidelity, and low loss requires specialized semiconductor fabrication processes, which are not compatible with the fabrication process used to make most solid-state integrated circuits. This increases the overall cost of the CCD sensors.

In CMOS sensors, signals from the photodiodes are read out as column readout lines, one row at a time. During readout, there is no shifting of charge from one pixel to another. Because CMOS sensors are compatible with typical CMOS fabrication processes, they allow integration of additional signal processing logic on the same substrate as the sensor array. This leads to reduction in the size and cost of a digital camera.

Pixel CMOS sensor circuits can be divided into passive pixels and active pixels. The active pixel sensor (APS) contains an active amplifier. There are three predominant approaches to pixel implementation in CMOS: photodiode-type passive pixel, photodiode-type active pixel, and photogate-type active pixel.



Passive pixel sensors (PPS) were developed first then active pixel sensors (APS) were developed to improve image quality. An APS has three transistors in a pixel, while a PPS has only one transistor. To achieve further improvement, an advanced APS that has four transistors in a pixel, the so-called 4T-APS, has been developed. The 4T-APS has greatly improved image quality, but has a very complex fabrication process.

CMOS active pixel sensors (APS) have performance competitive with charge-coupled device (CCD) technology, and offer advantages in on-chip functionality, system power reduction, cost, and miniaturization, so in the following part will be compared CMOS APS with CCD performances.

It was quickly recognized, almost as soon as the passive pixel was invented, that the insertion of a buffer/amplifier into the pixel could potentially improve the performance of the pixel. A sensor with an active amplifier within each pixel is referred to as an active pixel sensor or APS. Since each amplifier is only activated during readout, power dissipation is minimal and generally less than a CCD. In general, APS technology has many potential advantages over CCD's but is susceptible to residual fixed pattern noise FPN and has less maturity than CCD's.

The CMOS APS trades pixel fill factor for improved performance compared to passive pixels using the in-pixel amplifier. Pixels are typically designed for a fill factor of 20–30%, similar to interline-transfer (ILT) CCD's. Loss in optical signal is more than compensated by reduction in read noise for a net increase in signal-to-noise (S/N) ratio and dynamic range. Microlenses are commonly employed with low fill factor ILT CCD's and can recover some of the lost optical signal.

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## **COMPUTER-BASED TESTING**

The rapid growth of the Internet and intranets supports the infrastructure necessary for computer-based testing. The parallel growth of sophisticated computer programming and powerful computers offers new possibilities in testing, such as Computerized Adaptive Testing (CAT), where the responses of the subject dictate the nature of the test items to be presented. A Computer-Based Assessment (CBA), also known as Computer-Based Testing (CBT), e-exam, computerized testing and computer-administered testing, is a method of administering tests in which the responses are electronically recorded, assessed, or both. CBA systems enable educators and trainers to author, schedule, deliver, and report on surveys, quizzes, tests and exams. Computer-Based Assessment may be a stand-alone system or a part of a virtual learning environment, possibly accessed via the World Wide Web.

General advantages of Computer-Based Assessment (CBA) systems over traditional Pen-and-Paper Testing (PPT) are: increased delivery, administration and scoring efficiency; reduced costs for many elements of the testing lifecycle; improved test security resulting from electronic transmission and encryption; consistency and reliability; faster and more controlled test revision process with shorter response time; faster decision-making as the result of immediate scoring and reporting; unbiased test administration and scoring; new advanced and flexible item types; evolutionary step toward future testing methodologies.

Computer-Based Testing can introduce many possibilities, such as a new type of testing process, which can hardly be described and performed in traditional testing –

computerized adaptive testing (CAT). CAT successively selects questions so as to maximize the precision of the exam based on what is known about the examinee from previous questions. For example, if an examinee performs well on an item of intermediate difficulty, he will then be presented with a more difficult question. Or, if he performed poorly, he would be presented with a simpler question. Compared to static multiple choice tests that nearly everyone has experienced, with a fixed set of items administered to all examinees, computer-adaptive tests require fewer test items to arrive at equally accurate scores. There are many advantages of adaptive tests. Adaptive tests can provide uniformly precise scores for most test-takers. In contrast, standard fixed tests almost always provide the best precision for test-takers of medium ability and increasingly poorer precision for test-takers with more extreme test scores. Like any computer-based test, adaptive tests may show results immediately after testing. Adaptive testing, depending on the item selection algorithm, may reduce exposure of some items because examinees typically receive different sets of items rather than the whole population being administered a single set. Additionally, the testing organization benefits from the time savings; the cost of examinee seat time is substantially reduced.

It is also envisaged that computer-based formative assessment, in particular, will play an increasingly important role in learning. The use of CBA includes additional benefits which can be achieved from an organizational, psychological, analytical and pedagogical perspective.

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## **CORPORATE INFORMATION SYSTEMS**

The current trend of corporate information systems and their technical background - corporate networks - is transition to an integrated data transmission and broadcasting. Data and voice as well as fax machines and video are transmitted by one channel.

Technically, it is achieved through multiplexing of integrated transmission and further demultiplexing of separate information streams. Different classes of multiplexers allow to integrate information flows of various volumes, coming from both: small remote offices and regional offices of the major channels from 9.6 Kbps to 2.048 Mbps and higher. Frame Relay, X.25, ISDN, ATM are used as core technologies.

An important feature of ISDN networks is Bandwidth-on-Demand option, providing the necessary bandwidth connection, it is useful when traffic on the network. According to the same circuit switching principle another ISDN application is created - Connection-on-Demand option used for connection with very small offices or remote subscribers in low-intensity or occasional traffic channels. The organization of "communication on request" is also available on modem lines and at lower speeds.

X.25 networks, in which data transmission is designed for slow channels are extremely reliable. Frame Relay technology is noted for its operation speed and simultaneous data and digitized voice transmission. In addition, Frame Relay protocol allows efficient transfer of uneven time traffic.

The general form of the corporate network can be constructed on different channels - from leased lines to switched digital, including fiber-optic, satellite, radio and microwave channels, and on the basis of different protocols and ISDN, X.25, Frame Relay and ATM technologies.

## **HTML5**

One of the items with which you meet when you'll try to study web design will be - learning specialized web programming languages and special techniques. Whether you are only now starting to learn web design, or you're already a veteran in this craft, you've probably heard people here and there mention of HTML5.

In fact, HTML5 is an updated version of HTML / XHTML, which focuses specifically on what is required for web developers. HTML5 allows developers to embed a lot of new features in the projects they are working. For example, the function of a free drag and drop, new structural elements, as well as improved support for audio and video files.

Why it took the development of this language? Until 2004, HTML-language developed by a consortium WWW. Many developers are disappointed with enhancements to HTML-the language proposed by W3C. Many things are just not consistent with the present. A new group of developers called WHATWG (Web Hypertext Application Technology Working Group) has taken leadership on the development of language, which was later called HTML 5.

One of the most interesting and important features of HTML5 is support for 2D and 3D-graphics, which was previously only in Flash. Now developers will be able to adopt Web technology that will create advanced 2D and 3D objects on Web sites, which, besides, you can edit on the fly. Due to the fact that new browsers are beginning to use the resources of not only the processor, but the video card, lack of productivity when viewing 3D-objects on the sites should not be. In general, HTML5 itself very well with hardware. Unlike previous versions of the standard, HTML5 is able to access PC file system. This allows you to drag and drop files directly from your desktop browser to add them, for example, as an attachment to the letter. While maintaining the ability to choose multiple files at once and view them immediately after downloading.

HTML5 also able to use the accelerometer, which is common in business laptops, with the help of the user can flip the image on the web site to interact with content through the provision of the computer. The developers of Google has not yet reported as practically possible to apply HTML5 and accelerometer, but very excited about this opportunity and call it "fun."

An HTML5 (text/html) browser will be flexible in handling incorrect syntax. HTML5 is designed so that old browsers can safely ignore new HTML5 constructs. In contrast to HTML 4.01, the HTML5 specification gives detailed rules for lexing and parsing, with the intent that different compliant browsers will produce the same result in the case of incorrect syntax. Although HTML5 now defines a consistent behavior for "tag soup" documents, those documents are not regarded as conforming to the HTML5 standard.

As a conclusion, with the newest version of HTML we'll get substitution of Flash advert, which license is propriated, possibility of launching more dynamical pages on portable devices, rebasing to open-source standard.

## **PROBLEMS OF SMALL BUSINESS IN UKRAINE**

Many people dream of starting their own business. The opportunity to be your own boss, unlimited earning potential, and a number of other reasons lead thousands of people to start businesses each year. This article is dedicated to the problems you could face when you decide to start your business.

However, not all of these businesses succeed, mostly because the owners failed to completely think everything out in the beginning. Starting a business can be both exciting and scary. It is important to do your research before beginning a business so you can avoid the common problems.

Small businesses are constantly faced with problems before they can claim success. However, the difference between a well run business and one that is not is how they tackle their problems. They can often be faced with financial problems. Since business has its good and challenging months you may be swamped with bills when the tough months come. There are wages, rent etc to be paid and you don't know where to get the money. It is therefore advisable to always have an emergency account that can cushion you through the tough months.

Incompetent employees are yet another problem faced by small businesses. In comparison to larger companies, small businesses have a high employee turnover. It is always a real challenge for the business owners to get reliable and trustworthy employees. You may have employees who lie to customers about specific products or services for their own selfish gain. Unfortunately it is you who will end up "looking bad."

Customers can also be a source of problems for the small business. This is because sometimes you could have an in house problem like the office machinery lets you down and you cannot give your customer the service they require. Many customers get easily irritated and may think you cannot effectively run your business. They may even ask for their money back.

You can also be faced with problems if your suppliers do not deliver on time or as agreed on. This can be really frustrating and nerve racking especially if it is an order that is being waited for. Your family can also be a part of the problem especially if they are not willing to understand why you work so hard or late. They may begin to feel that they are secondary in your life. It is even difficult to go on vacation because you are constantly "on call". You should be ready to make sacrifices if you want to succeed in your business.

## **INFORMATION TECHNOLOGY OF DATA PROCESSING**

Information technology of data processing is designed to solve well-engineered problems, that have necessary input data and algorithms as well as other standard procedures of its processing are known. This technology is used at the level of operating (executive) activities of the semiskilled personnel in order to automate some routine repetitive operations of management work. Therefore, the implementation of information technologies and systems at this level will significantly increase staff productivity, exonerate them from routine operations, and probably will lead to the necessity of staff redundancy.

At the level of operations the following tasks are performed:

- processing transactions done by an enterprise;
- establishment of periodic monitoring reports on the status of an enterprise;
- receiving responses at all current requests and its organization in the form of paper documents or reports.

A sample would be a daily report of receipts and cash payments by a bank, formed in order to control the balance of cash, or a database query on the staff, which will provide data on the requirements for candidates of specific positions. There are several features associated with the processing of data that distinguish this technology from the others: tasks performance over data processing. Each enterprise is required by a law to have and keep data concerning its activities, that can be used in order to ensure management control at an enterprise.

Therefore, any company must have an information system of data processing and must develop an appropriate information technology:

- a solution of only well- engineered problems for which we can develop an algorithm;
- a performance of standard procedures for data processing. Existing standards define the standard data processing procedures and obligate its compliance by organizations of all types; a performance of the general volume of work in automatic mode with minimal manned operations;
- an usage of specified data. Company operations records have a detailed character, that allows the audit At the audit company operations are checked in chronological form, from the beginning to the end and from the end to the beginning; the emphasis on the events chronology;

Data storage: Much data at the operational activity level of must be saved for further usage either here or at another level. For its storage are developed databases. Reports (documents) creation in information technology of data processing is necessary to create documents for the head-office and employees of an enterprise, as well as for external partners. In this case, the documents can be created on demand or in view of performed operations by an enterprise, and periodically at the end of each month, quarter or year.

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## **MODERN AUDIO TECHNOLOGIES IN GAMES**

Sound is not as important as graphics in game development. The game developers spend more time on new features and effects for 3D graphics. However, the situation is changing - both users and developers are now paying more attention to sound. And modern projects dedicate to sound up to 40 % of the budget, time and manpower.

In March 2003 Creative announced the EAX Advanced HD. So, the EAX Advanced HD version 4 has the following new elements:

- Studio quality effects
- EAX4 presents 11 studio quality effects. You can use any of the effects listed below for 2D and 3D sound sources.
- AGC Compressor - automatic leveling of the sound source volume.

- Auto-Wah - auto version of the Wah pedal.
- Frequency Shifter for the input signal.
- Vocal Morpher - applies special effects to the input signal for the vocal (two 4-band formant filters for creation of the Vocoder effect with the modulation signals preinstalled).
- Pitch Shifter - shifts the frequency with the harmonics and time being the same.
- Ring Modulator - multiplies the input signal by another one (modulating) in the time domain.
- Environment Reverb - EAX's basic component.

These effects will give vent to your imagination. For example, the Flanger effect can be applied to a machine gun to make an effect of overheating or faster shooting in the real-time mode, without changing the audio file, or to emulate the transmitter effect with Distortion and Equalizer.

### **Multiple effect slots**

Another feature announced is several slots for effects. You can add there several effects mentioned. For example, you can hear sound in several environments simultaneously, or add to the Distortion and Equalizer in the transmitter the effect of Environment Reverb to create illusion of a transmitter in the room with echo.

### **Multiple Environments**

The sound from each source is spread both in its own environment and in the listener's one. Occlusions, Obstructions and Exclusions are applied both to the sources' environments and to the listener's one. Thus we get the result of interaction of the sources in their own environments plus interaction in the listener's one.

With these settings it's needed to use the EAX4 functions a lot: it's necessary to define the environments for the sources and listener, and effects for each source, but the sound becomes more realistic - the sources sound as if they are located in different rooms, while in the EAX3 they were simply in a different room with the listener.

**Zoned effects.** The concept of zones is very similar to Room or Environment.

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## **MONTE CARLO METHOD**

Monte Carlo methods (or Monte Carlo experiments) are a class of computational algorithms that rely on repeated random sampling to compute their results. Monte Carlo methods are often used in simulating physical and mathematical systems. Because of their reliance on repeated computation of random or pseudo-random numbers, these methods are most suited to calculation by a computer and tend to be used when it is unfeasible or impossible to compute an exact result with a deterministic algorithm. There is no single Monte Carlo method; instead, the term describes a large and widely-used class of approaches. However, these approaches tend to follow a particular pattern:

1. Define a domain of possible inputs.
2. Generate inputs randomly from the domain using a certain specified probability distribution.
3. Perform a deterministic computation using the inputs.
4. Aggregate the results of the individual computations into the final result.

In 1940<sup>th</sup> years physicists at Los Alamos Scientific Laboratory were investigating radiation shielding and the distance that neutrons would likely travel through various materials. Despite having most of the necessary data, such as the average distance a neutron would travel in a substance before it collided with an atomic nucleus or how much energy the neutron was likely to give off following a collision, the problem could not be solved with analytical calculations. John von Neumann and Stanislaw Ulam suggested that the problem be solved by modeling the experiment on a computer using chance. Being secret, their work required a code name. Von Neumann chose the name "Monte Carlo".

In 1950<sup>th</sup> years the method was used for calculations by development of a hydrogen bomb. In 1970<sup>th</sup> years in new area of mathematics — to the computational complexity theory it has been shown that there is a class of tasks, complexity (the amount of the calculations necessary for obtaining of the exact answer) which grows with dimensionality of the task exponentially. Sometimes it is possible, having sacrificed accuracy, to find the algorithm which complexity grows more slowly, but there is a considerable quantity of tasks for which it can't be made (for example, the task of scoping of a convex body in a n-dimensional Euclidean space) and the Monte Carlo method is unique possibility for obtaining of enough exact answer for comprehensible time.

Now the main efforts of researchers are directed on creation of effective Monte-Carlo of algorithms of various physical, chemical and social processes for parallel computing systems.

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## **COMPUTER USERS**

Importance of Computers in Medicine. Most hospitals and clinics rely on computers for their administration, financials, and data submission and retrieval purposes. Computers are the excellent means for storage of patient related data. Computer software is used for diagnosis of diseases. Advanced computer-based systems are used to examine delicate organs of the body. Many of the modern methods of scanning and imaging are largely based on the computer technology. Computers are widely used for the generation of 3-D images in medicine.

Role of Computers in Education Computer education forms a part of the school and college curricula, as it is important for every individual today, to have the basic knowledge of computers. The advantages of computers in education include an efficient storage and rendition of information, quick information processing and very importantly the saving of paper. It is easier to store information on computers than maintaining hand-written notes. Students find it easier to refer to the Internet than searching for information in fat reference books. Online education has revolutionized the education industry. The computer technology has made the dream of distance learning, a reality.

Role of computer conferencing Computer mediated communication has become an integral part of e-learning courses. The main tool used is asynchronous computer conferencing. Students and teachers can communicate with each other by posting messages to an online conference. The discussion can be between students or between students and teachers. Messages posted are visible to the entire group and can be searched and archived.

Computers in architecture and interior design Digital architecture uses computer modeling, programming, simulation and imaging to create both virtual forms and physical structures. The terminology has also been used to refer to other aspects of architecture that feature digital technologies. Architecture created digitally might not involve the use of actual materials (brick, stone, glass, steel, wood). It creates places for human interaction that do not resemble physical architectural spaces.

Computers in science. As a discipline, computer science spans a range of topics from theoretical studies of algorithms and the limits of computation to the practical issues of implementing computing systems in hardware and software. Here are some major fields of CS: theoretical computer science, theory of computation, algorithms and data structures, computer elements and architecture, computational science, artificial Intelligence, software engineering.

A life without computers would seem almost unimaginable for many. The importance of computers is evident today and having the perfect know-how of computers can only propel one's career in the right direction. Today, computers are a part of almost every industry. They are no more limited to the software industry. They are widely used in networking, information access, data storage and the processing of information .

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### **GLONASS FOR HOUSEWIVES**

In five years the Russian radioelectronic industry will be a key player in the services market.

The most prestigious and large-scale project of Russian microelectronics, creation of IT systems for the GLONASS system of satellite navigation, will get additional support from the state.

This week the Government will consider new measures for support of domestic microelectronics within the framework of a private-and-public partnership. The matter concerns dozens of high-tech projects. The amount of funding of the new federal target program of Development of the Electronic Component Base and Radioelectronics is 186 bln RUR. Officials of the Ministry of Industry and Trade are of the opinion that the sum is going to be exceeded since the state expressly signals to private investors that it is interested in development of the economy sector concerned.

Representative of the Ministry of Industry and Trade have explained to the *Rossiyskaya Gazeta* reporters that the ultimate objective is the implementation of nanotechnologies, bio-, micro- and radioelectronics in such aspects of the Russian's everyday life as healthcare, education, housing and utilities sector, communications and transportation. Currently only 30-40% of radioelectronic industry products in the Russian market are intended for civilian purposes with the rest designed for needs of defense. However, already in five years the situation is to turn opposite. But in order to make it possible one has



to provide economic incentives to domestic producers. According to the Government's design, by 2015 Russian radioelectronic industry is to become a key player in the services market in this country. Meanwhile, electronics production in Russia relies mostly on imported component parts. Imported chips are used in the production of TV and radio-transmitters and introduced in the new generation biopassports. The task thus consists in remedying the situation and arranging domestic element base production. It is proposed to use a scheme already approbated in car industry for development of cutting-edge electronic technologies, primarily — for telecommunications and navigation equipment market. First, it is intended to patronize domestic manufacturers through prohibitive customs duties on import of similar products already fabricated in Russia. This country's specialists are keen on production of radio-frequency equipment for digital television and mobile communications. Thus, some people in the Ministry believe that the Russian radioelectronic industry is quite capable to create, for instance, a super mobile telephone equipped with a receiver of the domestically developed GLONASS satellite search system.

Second, one is going to open the border and offer preferences to renowned foreign manufacturers willing to open factories in this country or establish joint ventures. In car industry such a policy turned fruitful. World automobile giants literally rushed jostling into Russian market. However, it is true that the task being set in electronics sector is much more complicated than that one had to deal with in car industry. As representatives of the Ministry of Industry and Trade explain, the manufacturers intending to deploy production facilities in Russia need to own the rights to design and technological documentation while the controlling interest will be retained by a Russian Federation resident.

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## **LABVIEW: GRAPHICAL, DATAFLOW PROGRAMMING**

LabVIEW is a graphical programming environment used by millions of engineers and scientists to develop sophisticated measurement, test, and control systems using intuitive graphical icons and wires that resemble a flowchart. It offers unrivaled integration with thousands of hardware devices and provides hundreds of built-in libraries for advanced analysis and data visualization – all for creating virtual instrumentation. The LabVIEW platform is scalable across multiple targets and OSs, and, since its introduction in 1986, it has become an industry leader.

Like most people, engineers and scientists learn by seeing and processing images without any need for conscious contemplation. Many engineers and scientists can also be characterized as “visual thinkers,” meaning that they are especially adept at using visual processing to organize information. In other words, they think best in pictures. G code is typically easier for engineers and scientists to quickly understand because they are largely familiar with visualizing and even diagrammatically modeling processes and tasks in terms of block diagrams and flowcharts (which also follow the rules of data flow). In addition, because dataflow languages require you to base the structure of the program around the flow of data, you are encouraged to think in terms of the problem you need to solve. For example, a typical G program might first acquire several channels of temperature data, then pass the data to an

analysis function, and, finally, write the analyzed data to disk. Overall, the flow of data and steps involved in this program are easy to understand within a LabVIEW diagram.

LabVIEW is different from most other general-purpose programming languages in two major ways. First, G programming is performed by wiring together graphical icons on a diagram, which is then compiled directly to machine code so the computer processors can execute it. While represented graphically instead of with text, G contains the same programming concepts found in most traditional languages. For example, G includes all the standard constructs, such as data types, loops, event handling, variables, recursion, and object-oriented programming.

The second main differentiator is that G code developed with LabVIEW executes according to the rules of data flow instead of the more traditional procedural approach found in most text-based programming languages like C and C++. Dataflow languages like G promote data as the main concept behind any program. Dataflow execution is data-driven, or data-dependent. The flow of data between nodes in the program, not sequential lines of text, determines the execution order.

While G code provides an excellent representation for parallelism and removes the requirement on developers to understand and manage computer memory, it is not necessarily ideal for every task. In particular, mathematical formulas and equations can often be more succinctly represented with text. For that reason, you can use LabVIEW to combine graphical programming with several forms of text-based programming. Working within LabVIEW, you can choose a textual approach, a graphical approach, or a combination of the two.

For example, LabVIEW contains the concept of the Formula Node, which evaluates textual mathematical formulas and expressions similar to C on the block diagram. These mathematical formulas can execute side by side and integrate with graphical LabVIEW code.

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## **NEURAL NETWORK. GROUP METHOD OF DATA HANDLING**

An artificial neural network (ANN), usually called "neural network" (NN), is a mathematical model or computational model that is inspired by the structure and functional aspects of biological neural networks. It consists of an interconnected group of artificial neurons and processes information using a connectionist approach to computation. In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase. Modern neural networks are non-linear statistical data modeling tools. They are usually used to model complex relationships between inputs and outputs or to find patterns in data.

These networks are also similar to the biological neural networks in the sense that functions are performed collectively and in parallel by the units, rather than there being a clear delineation of subtasks to which various units are. Currently, the term Artificial Neural Network (ANN) tends to refer mostly to neural network models employed in statistics, cognitive psychology and artificial intelligence. Neural network models designed with emulation of the central nervous system (CNS) in mind are a subject of theoretical neuroscience and computational neuroscience. Neural network models in artificial intelligence are usually referred to as artificial neural networks (ANNs); these are essentially simple

mathematical models defining a function  $f: X \rightarrow Y$  or a distribution over  $X$  or both  $X$  and  $Y$ , but sometimes models also intimately associated with a particular learning algorithm or learning rule. The network function  $f(x)$  is defined as a composition of other functions  $g_i(x)$ , which can further be defined as a composition of other functions.

Group method of data handling (GMDH) is a family of inductive algorithms for computer-based mathematical modeling of multi-parametric datasets that features fully-automatic structural and parametric optimization of models. GMDH is used in such fields as artificial intelligence, neural networks, data mining, knowledge discovery, prediction, complex systems modeling, optimization and pattern recognition. A GMDH model with multiple inputs and one output is a subset of components of the base function:

$$Y(x_1, \dots, x_n) = a_0 + \sum_{i=1}^m a_i f_i$$

The method was originated in 1968 by Prof. Alexey G. Ivakhnenko in the Institute of Cybernetics in Kyiv.

The tasks to which artificial neural networks are applied tend to fall within the following broad categories:

- Function approximation, or regression analysis, including time series prediction, fitness approximation and modeling.
- Classification, including pattern and sequence recognition, novelty detection and sequential decision making.
- Data processing, including filtering, clustering, blind source separation and compression.
- Robotics, including directing manipulators, Computer numerical control.

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## **GEOGRAPHIC INFORMATION SYSTEMS IMPLEMENTATION IN UKRAINE**

1. The problems of natural resources operational management are becoming an issue in Ukraine, due to the processes of natural resources management and ecology, also due to environmental and anthropogenic catastrophic phenomena. Mentioned processes yield a huge loss to the national economy annually. The intensity of natural resources usage in a number of Ukrainian regions will increase from year to year and it is connected with investment potential of the country. As a consequent, given processes will only lead to the complications of anthropogenic problems. That's why the nature resources management should be put into practice on the basis of modern informational technologies and that is the application of Geographic Information Systems (GIS).

2. From the end of 80<sup>th</sup> strong integration potential of GIS-technologies is involved in global and international projects like Global Environment Monitoring System. Compared to the USA, the geoinformation market in Europe is less developed because of essential differences in political approaches to GIS-technologies usage.

3. The main problems that deter the implementation of GIS-technologies in Ukraine are insufficient financing (investments, state financing), the absence of legislative base (the

absence of the access to the information, connected with national security), lack of skilled personnel, weak interaction between departmental structures concerning data collection, processing and interpretation.

4. Implementation of GIS-technologies into country's economy facilitates the development of so-called "knowledge driven economy", or economy built on knowledge. Such economy is a pledge of dynamic country development. This rule was confirmed by the rapid growth of the Baltic States for the last 10 years and Asian countries for the last 20 years. It means that orientation of national economy on advanced technologies will create new competitive workplaces in the national companies.

5. Development of GIS, as one of the components of enterprise administrative systems, allows making proper administrative and investment decisions efficiently, basing on integral data analysis. For enterprises the activity of which is often connected with a great risk of accidents, the implementation of GIS-technologies will allow to organize and conduct virtual situational modeling. GIS give an opportunity to increase the quality of administrative decisions on initial level by means of forming scenario sets for changes and development of the situation.

6. Geographic Information Systems development and implementation is a necessary condition for increase of managerial decisions quality, and successful integration of Ukraine into the world cyberspace.

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### **CACHED EXCHANGE MODE**

Microsoft Outlook 2003 and newer versions introduce a new feature called Cached Exchange Mode, which is actually an improved version of offline folders in Outlook older versions. Cached Exchange Mode lets users move between connected and disconnected environments without interrupting their experience in Outlook. Also, it insulates users from network latency and connectivity issues while they are using Outlook.

Traditionally, Outlook plus Exchange supported "Online" and "Offline" modes. Offline mode was optional. In Online mode, it was simply acting as a network client for the Exchange server, and just about every operation involved talking to the server. In Offline mode, Outlook was disconnected from the server, and using an "Offline Store" (.OST file) for everything. An Outlook client configured to support Offline operation would, when Online, periodically synchronize the OST to the Exchange server.

Online Mode works directly by using information from the server. When new information is required in Outlook, a request is made to the server and the information is displayed. Mailbox data is only cached in memory and never written to disk.

When the Exchange server, database, or mailbox associating with the offline folder (.OST file) file is reset, or there is an inconsistency between the Exchange mailbox and the OST file, then if you are running Outlook 2002 or older versions, or running Outlook 2003 and newer versions but have Cached Exchange Mode disabled, and choose to work online, then Outlook will create a new OST file for the new mailbox. The old OST file will not be deleted, but you cannot access the data in it. Later when the original mailbox is available again, you will be able to access the data in the old OST file, but those in the new OST file will be inaccessible

again. If you need to access the data in both OST files, you need to edit the Outlook profiles manually to redirect them to the corresponding OST files, which is very inconvenient.

The benefits of enabling this is reducing network traffic, faster responds time of the Outlook client (especially with large attachments), being able to use the Junk E-mail Filter and being able to work off-line. The primary benefits of using Cached Exchange Mode are shielding the user from network and server connection issues, facilitating switching from online to offline for mobile users

By caching the user's mailbox and the OAB locally, Outlook no longer depends on on-going network connectivity for access to user information. In addition, users' mailboxes are kept current. If a user disconnects from the network—for example, by removing a laptop from a docking station—the latest information is automatically available offline.

In addition to using local copies of mailboxes to improve the user experience, Cached Exchange Mode optimizes the type and amount of data sent over a connection with the server.

When you create a new profile in Outlook 2003 and newer Cached Exchange mode is enabled by default. When you upgrade from a previous Outlook version with an Exchange mailbox to Outlook 2003 and newer Cached Exchange mode is disabled by default.

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### **MALWARE DETECTION FUZZY LOGIC**

The number of new malware specimen has significantly increased over the last years and basically shows an exponential growth. The vast amount of new specimen cannot be analyzed fast enough. Thus, many of the modern antivirus products are not able to keep up with the growing threat. Statistics show that less than 5% of all submitted malware samples were detected by all virus scanners.

Polymorphic malware contains decryption routines which decrypt encrypted constant parts of the malware body. The malware can mutate its decryptors in subsequent generations, thereby complicating signature based detection approaches. The decrypted body, however, remains constant. Metamorphic malware generally does not use encryption, but mutates its body in subsequent generations using various techniques, such as junk insertion, semantic NOPs, code transposition, equivalent instruction substitution and register reassignments. These techniques are likely to shrink the usable “constant base” for strict signature based detection approaches.

Seminal studies on graph-based binary analysis are due to Halvar Flake, who has been using graphs and similar comparison metrics to find differences between different versions of a given binary. His ideas and algorithms reveal some of the advantages in the automation of reverse engineering and code analysis. Ero Carrera proposed Digital Genome Mapping, a technique that uses graph theory to help in the analysis and identification of samples with a similar internal structure. A control flow graph (CFG) signature which is the list of edges connecting basic blocks of a function, and a call-tree signature which is a fingerprint of which other functions are called inside a function body.

The work by Kruegel aims at detecting polymorphic worms. The authors start from the fact that the structure of an executable is described by its CFG. They extract the CFG of a number of worms, than they create all the subgraphs of a given size of the CFG. They perform

the detection doing the same with the file to analyze, and comparing all the subgraphs. Matches (i.e graph isomorphism's) are a symptom that the file is malicious. The system is made more robust by the use of a coloring system that associates a "color" to a given type of instructions inside a basic block. Match between subgraphs requires not only isomorphism but also color correspondence.

A similar approach is used by Bruschi. First of all a disassembling phase is performed on the executable. Then a normalization phase follows aimed at reducing the effects of most of the well-known mutation techniques and at unveiling the flow connection between the benign and the malicious code. Subsequent analysis is performed on the normalized code.

Kruegel propose a kernel-level rootkits detection method based on symbolic execution. Kernel module binaries are symbolic executed in order locate instructions that write in memory areas of the kernel where modules usually don't write, e.g. the syscall table.

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## **SURVEILLANCE SOCIETY: NEW HIGH-TECH CAMERAS WATCHING YOU**

In the era of computer – controlled surveillance, your every move could be captured by cameras, whether you're shopping in the grocery store or driving on the freeway. In the nearest future all environment will be equipped with new high-tech cameras all feed into a computer system. The system is capable of running software that analyzes the imaginary and automatically alerts human overseers to any suspicious events.

The software can spot, when somebody abandons a bag or backpack. It also can count bodies and assessing, when people are grouped too tightly together, which might indicate a fight or gang activity. A camera with artificial intelligence can be in required place 24 hours per week, doesn't need a bathroom break, doesn't need a lunch break and doesn't go on vacations.

We have arrived in a unique moment in the history of surveillance. The price of both megapixels and gigabytes has plummeted, making it possible to collect a previously unimaginable quantity and quality of data. Advantages in processing power and software, meanwhile, are beginning to allow computers to surmount the greatest limitation of eyeballs to effectively observe the activity on dozens of videos screens simultaneously. Computers can't do all the work by themselves, but they can expand the capabilities of humans exponentially. Such technologies don't stop crime but they make a dent; weekly losses are reduced by an average of 15 percent.

Also, there is software that automatically analyzes and tags video contents, from colors and locations of cars to the characteristics of individual faces that pass before the lens.

At government facilities, city centers, shops, airports and public places, there are simply too many people for security guards to watch all at once. But cameras connected to analytics software can pay attention to hundreds, even thousands, of people at a time. Behavioral analysis programs can learn "normal" human patterns in location, highlighting and logging behaviors of individuals who move or act in unusual ways. The system can adjust as a pattern of human behavior changes and then can attention to behavior that deviates from the new "normal".

Used by banks, hotels and stores, “searchable” systems automatically create a template of every face that passes in front of security cameras. The system creates a mathematical model based on the geometry of each person’s face that can be compared to a central list of known suspects for instant alerts. The technology can also automatically log events based on an automated object recognition analysis of an entire scene. Because all events are cataloged, several months’ worth of data can be analyzed in minutes.

One of the most popular new technologies is the license-plate reader, or LPR. Its plate is consists of cameras mounted on the outside of a squad car and connected to a computer database in a vehicle. The plate hunter employs optical-character-recognition technology. LPRs automate the process of “running a plate” to check if a vehicle is stolen or if the driver has any outstanding warrants.

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## **THE F# PROGRAMMING LANGUAGE**

F# is a multi-paradigm programming language for the Microsoft .NET platform, based on the OCaml language. Its strong side is the possibility of combining direct usage of .NET libraries, and others .NET languages (C#, VB.NET) with the possibilities of functional programming. F# is a strongly typed language that uses type inference, it also uses pattern matching to resolve names into values and allows functions with side effects (so, it's not pure functional language).

F# was initially developed by Don Syme at Microsoft Research but is now being developed at Microsoft Developer Division and is being distributed as a fully supported language (such as C# or VB.NET) in the .NET Framework and Visual Studio as part of Visual Studio 2010.

Microsoft is actively investing in F#; this language is young and actively developing; all this makes F# very interesting for .NET developers to start learning functional programming. It is also interesting for those functional programmers who want to try .NET platform benefits.

As noted above, F# is based on OCaml language, this step was taken for existing OCaml-code maximum support. There is no literature on F# in Ukrainian (or even Russian) so far, but since there are many books on OCaml, you should not have any problems with self-learning.

F# syntax is built on mathematical notation and programming i s something like algebra. There is no need to explicitly define function's return value. Since F# is strongly typed, it is not possible to use functions with values of inappropriate type. Functions, like any other values, have defined type. F# uses type inference, as a result, data types need not be explicitly declared by the programmer; they will be deduced by the compiler during compilation. However, F# also allows explicit data type declaration.

Another powerful technique of F3 is lists initializations, which allows you to create rather complicated lists, arrays and sequences (equivalent to IEnumerable) directly. One of the most common functional programming techniques — pattern matching — was also inherited from ML-languages: F# uses pattern matching to resolve names into values. F#, like other .NET languages, can use .NET types and objects, using an imperative object-oriented style of

programming. For imperative programming, F# supports for and while loops, if-then-else flow control construction, arrays and support for creating Object types (equivalent to .NET classes).

F# gives the programmer several options that are perfectly interact with each other. Programmer is not obliged to know everything about classes, interfaces, structures, inheritance, etc. He just needs to learn some simple designs.

So, F# is a general purpose programming language. It can solve problems of any kind. Written in F#, code is type secure as the other .NET languages code; the only thing, code in F# is often more compact than the same code on the other .NET languages. One of the main ideas of F# is to make sure that your code and your types in the functional programming language can be easily accessed from other .NET languages. F# is the only functional programming language in which absolutely everything you write will be immediately available for use in other languages.

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## **SOFTWARE FUNCTIONAL TESTING**

Functional testing - is the process of attempting to find discrepancies between the program and its functional requirements or specifications. Functional testing may be performed manually (manual testing) or using specific tools (automated testing).

Quality is property which shows that a product meets its requirements or exceeds them. There are two aspects of the quality: product quality and process quality. Some quality criteria assumptions: if customer accepts the implemented product this is enough to say that the quality of the product is good; product quality is defined by good processes (development, management, testing etc.); if the product meets its requirements – this is good product; good product has some advantages and doesn't have critical problems.

The goals are defining defects in software product and it is documenting; determine if software meets its requirements as defined in the Software Requirements Specification (SRS) and other relevant documents; take an objective decision about possibility of software product delivery to customer; the decision should be documented in test result report.

Testing axioms are testing, like most other activities, must start with objectives; a good test case is one that has a high probability of detecting an undiscovered defect, not one that shows the program works correctly; a necessary part of every test case is a description of the expected result; one of the most difficult problems in testing is knowing when to stop; it is ineffective to test your own program; avoid non-reproducible or on-the-fly testing, although sometimes, this way is defensible.

If we expect same result from two tests passing these tests are equivalent. The set of tests represents the equivalence class if: all tests intend for same defects finding; one test from the set finds a defect, other ones will most probably find same defect; one test from the set does not find a defect, other ones will most probably not find same defect. Criteria for equivalence classes selection are tests use same values of input test data; for tests passing we perform same operations of the program; same values of output data are formed in results of all tests; all tests lead to execution of the error handling block; no one test from the group leads to execution of the error handling block. All tests corresponding to one of these items may be considered as equivalent class of tests.



Classic Testing Mistakes or Testing Myths are assurance that you can find all defects in the software product; assurance that you capable to test the program completely; thinking the testing team is responsible for assuring quality; thinking that goal of testing is to find bugs only; not finding the important bugs; not reporting usability problems; starting testing too late; putting stress and load testing off to the last minute; not testing the documentation; not testing installation procedures; failing to correctly identify risky areas; paying more attention to running tests than to designing them; not reviewing test designs; checking that the product does what it is supposed to do, but not that it doesn't do what it is not supposed to do; poor bug reporting; attempting to automate all tests; expecting to re-run all manual tests.

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## **ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (OFDM) IN WIMAX**

OFDM is a modulation method that is already used in wireless computer networks (WLAN), such as IEEE 802.11 in the U.S., ETSI BRAN in Europe, ARIB MMAR in Japan, in WiMAX, mobile communications, in digital audio and video broadcasting. The concept of this method of modulation, mainly based on the well-known since the 1950's. modulation technique with a number of subcarriers (Multi-carrier modulation — MCM). But it is also include the latest achievements of the past decade in the field of digital data transmission and high-performance modulation methods. These methods provide high-quality performance of communication systems in the presence of interference, Doppler frequency shift, radio-signal decay, etc.

In this method there is an effective division of the sequence of data symbols in parallel flow with increasing duration of each symbol. Transmitted sequence of data symbols  $x_{m,k}$  is divided into blocks of  $N$  symbols. Each block of  $N$  consecutive symbols is converted into a block of  $N$  parallel symbols. Duration of every block is  $T = NT_x$ . Received symbols modulate  $N$  respective subcarrier frequencies.

If the block length  $N$  is chosen like  $T = NT_s \gg LT_s$ , where  $LT_s$  - duration of the pulse response characteristic channel of the subcarrier frequency (the half of the channel), the intersymbol interference (overlay of adjacent blocks to each other) is significantly reduced. It can be eliminated completely by a slight reduction in capacity, if between successive modulated OFDM-blocks to insert the guard interval  $GT_s > LT$ .

The main advantage of OFDM, contributing to its widespread use, is the fact that the modulation and demodulation can be performed in discrete form using discrete (DFT), and, consequently, fast (FFT), Fourier transform. Another important advantage of OFDM is the simplicity of reducing the influence of intersymbol interference (ISI). This is achieved by entering guard interval. Guard interval added to the original block in the form of cyclic prefix length  $G$  readout interval  $T_s$ .

Using OFDM provides a standard IEEE 802.16 (WiMax). According to this technology in the allowed band (it may have a width of 1,5, 10, 20, 25 and 28 MHz) generated the  $N$  subcarrier frequencies. Transmitted information, having transmission rate  $R$  bps, divided by streams, whose number equals is the number of subcarriers. The duration of the bit interval  $T_0 = 1/R$ . Before the modulation each pulse of parallel stream is stretched in time

(растягивается во времени) in  $N$  times. The length of bits became  $NT_6$ . Each pulse from the parallel flow modulate "their" subcarrier

The communication system with OFDM is the most sensitive to jitter subcarrier frequencies and phases. This will mainly restrict reception and recognition. Modulation on each subcarrier, can be carried out in any way. Of course, the desirability in this case, use the spectrally-efficient ways to minimize the bandwidth of each subcarrier. In WiMAX used BPSK, QPSK and QAM.

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## **SEMANTIC WEB**

The Semantic Web is an evolving collection of knowledge, built to allow anyone on the Internet to add what they know and to find answers to their questions. Information on the Semantic web, rather than being in natural language text, is maintained in a structured form which is fairly easy for both computers and people to work with.

The structuring is simple: knowledge is expressed as descriptive statements, saying some relationship exists between one thing and another. "Ann has a mother, Olena" or "Olena is a mother of Ann". An enormous amount of people's knowledge can be expressed in sentences like these.

This kind of information structuring was standardized for the Web in 1999 as RDF (Resource Description Framework), but the basic technique goes decades back.

Of course names like "Ann" do not work very well to identify a specific person in the whole world, so on the Semantic Web we identify each of the things (and the relationships) using more complicated unambiguous names. The names we use are web addresses (sometimes called URLs or URIs). This can cause some confusion (is "http://www.ibm.com" a company or the company's web site?), but it also turns out to be very useful for locating information about the thing.

We also have special names for text strings (literals), and we allow temporary names which function like pronouns. This lets us write "The country with the ISO country code 'US' has a president who has the name 'Barack Obama'" without ever using an identifier for the US.

Our system cannot directly express things like "Every person was once an embryo", but it can at least convey expressions in other languages, so people and systems which understand those languages can benefit from the Semantic Web as a kind of shared database. Some information will remain in natural languages, like English, which in some cases is easier for people to use. Other information may be stored in languages designed primarily for computers to understand.

Some facts (like "Olena is a mother" and "A mother is a kind of parent") lead logically to other facts ("Olena is a parent"). That is often intuitive to people, but can be very hard to explain to a computer. When properly programmed, however, computers can be very helpful in figuring out which facts follow logically from other facts.

A precise explanation of one's terms and reasoning in some subject area, which can allow computers to help, is called an ontology. Ontologies can be expressed in various languages and carried by the Semantic Web. Due to them, computers can sometimes act as if they "understand" the information they are carrying. This is where the term "semantic" comes

in; on this web, we try to make the meanings so clear that even a computer can understand them.

No logic languages have yet been recommended for the Semantic Web. Some of the experimental languages are RDF Schema, DAML+OIL, and swap/log.

The knowledge on the Semantic Web is an aggregate of contributions from many sources, much as the Web is an aggregate of many web sites. The answers to a question you ask, like the results of a web search, will depend to some degree on who you trust, which systems are working at the time you ask, and what kind of search techniques are being used.

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## **THE ANALYSIS OF PRINTING ON TEXTURE FABRICS**

Swift world development of technique stimulates appearance of more and more new companies, enterprises and productions. Printing on soft fabrics is one of the most effective advertising methods for any client. At printing on textile there is a question – by what method to perform the order, to stagger a customer and his client by sight and materially.

There are two methods of printing on texture – direct and indirect (with transfer).

According to our research we can name two main direct methods of printing: the stenciled method or ink-jet printer method. At the stenciled method an image is carried directly on fabric. But not always it is possible to get exact imposition of paints on some material (jackets, blazers, caps, and other wares) and quite not possibly do it on synthetic fabric. On the basis of the conducted analysis such advantage was educed – large assortment of various effects (metal-backer, light absorptive, light reflecting, aromatic, that shine under UV-light, to the mother of pearl, and other). This method is advantageous at printing from 50 units, it is possible to print the small drawings, make alteration to the image, even for every good.

In case of receipt of image an ink-jet printer notably the assortment of effects grows short, though in latter days this method purchased development, printing became accessible to dark fabrics. Among defects it is possible to distinguish such as an image on dark fabric is not bright, it is impossible to get a volumetric image and metal-backer image, high price on equipment.

Analyzing the varieties of the printing by thermo transfer, classification of transfers on the method of their making was carried out. Transfer can be executed by such methods, as digital, stenciled and dye sublimation. Paints can be classified on plastisols, hydrogen, and solvent and dye sublimation. Digital transfers have short life and lose the kind with washable. Stenciled transfer creates the saturated image which sticks long. In dye sublimation paint penetrates deeply between the fibres of fabric. This transfer has strong image but only on synthetic materials.

The transfers have several advantages. For example, transfer can be printing on standard equipment in every print shop. It hasn't restrictions in used of number colors. Transfer provides an ideal combination of color, thin lines are transferred without any problems and the resolution is high. If we have problem with image we can change only transfer without product.

There are different paints which can use for different needs. It can be plastisols, hydrogens and solvent.

Plastisols does not dry out on a form, stick to fabric. They can be foamy (is used for

volume image), phosphoric and can make "metallic" effect.

If we want to print on natural and some synthetic to fabric we must use hydrogens. They are high-quality dye of fibres but they dry up very quickly on the form. So this fact shows us the complicating of this process.

Solvent of paint is used only for synthetic fabrics, and dye sublimation paints are for printing on synthetics texture with small drawings, because of image that gets turns out proof, like to offset.

Today's market is so varied that it is difficult to make a right choice. That's why we must consider all the pros and cons the the desired result is obtained.

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## **OPEN CL**

OpenCL (Open Computing Language) is the first open, royalty-free standard for cross-platform, parallel programming of modern processors found in personal computers, servers and handheld/embedded devices. OpenCL greatly improves speed and responsiveness for a wide spectrum of applications in numerous market categories from gaming and entertainment to scientific and medical software.

By creating an efficient, close-to-the-metal programming interface, OpenCL will form the foundation layer of a parallel computing ecosystem of platform-independent tools, middleware and applications.

OpenCL gives any application access to the Graphics Processing Unit for non-graphical computing. Thus, OpenCL extends the power of the Graphics Processing Unit beyond graphics. OpenCL is analogous to the open industry standards OpenGL and OpenAL, for 3D graphics and computer audio, respectively.

OpenCL consists of an API for coordinating parallel computation across heterogeneous processors; and a cross-platform programming language with a well-specified computation environment.

The OpenCL standard:

- Defines a configuration profile for handheld and embedded devices
- Efficiently interoperates with OpenGL, OpenGL ES and other graphics APIs
- Supports both data- and task-based parallel programming models
- Defines consistent numerical requirements based on IEEE 754
- Utilizes a subset of ISO C99 with extensions for parallelism

OpenCL 1.1 is the latest version of the standard. Highlights include:

- Operations on regions of a buffer including read, write and copy of 1D, 2D or 3D rectangular regions
- Improved OpenGL interoperability through efficient sharing of images and buffers by linking OpenCL event objects to OpenGL fence sync objects
- Global work-offset which enable kernels to operate on different portions of the NDRange;
- Memory object destructor callback
- Enhanced use of events to drive and control command execution

- Host-thread safety, enabling OpenCL commands to be enqueued from multiple host threads
- Sub-buffer objects to distribute regions of a buffer across multiple OpenCL devices
- Additional OpenCL C built-in functions such as integer clamp, shuffle and asynchronous strided copies
- Writes to a pointer of bytes or shorts from a kernel, and conversion of atomics to 32-bit integers in local or global memory

OpenCL supports a wide range of applications, from embedded and consumer software to HPC solutions, through a low-level, high-performance, portable abstraction.

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## **ORIENTIERUNGSSYSTEME VON KLEINSATELLITEN**

Eines der größten Probleme, die praktisch während des gesamten Fluges, die überwiegende Mehrheit der künstlichen Satelliten gerichtet werden muss, ist auf eine bestimmte Winkelbewegung gewährleisten. Der Satellit hat die richtige Winkelstellung in Bezug auf Orientierungspunkte durch Drehung um das Zentrum der Masse. Als solche Orientierungspunkte dienen sichtbaren himmlischen und irdischen Objekten (Sterne, Sonne, Horizontlinie), oder Richtungen im Raum (lokale vertikal, der Vektor des Erdmagnetfeldes, der Geschwindigkeitsvektor der Luftströmung), die von Messgeräten bestimmt werden kann.

Wenn man für die Schaffung der Auswirkungen erforderlichen Flussrate von der Funktionsweisendes Körpers oder die Energie braucht, die an Bord gespeichert ist, und für die Bildung dieser Auswirkungen ein Block von Logik, Sensoren, Orientierung und Leitungsorgane erfordert, ist ein solches System eine aktive Lageregelungssystem genannt. Mit diesen System kann man ganz willkürlich und schnelle Winkeldrehen realisieren. Passive Lageregelungen, die Wechselwirkung mit externen Feldern des natürlichen Ursprungs benutzen, verbrauchen keine die Funktionsweisendes Körper und die Energie, die an Bord des Satelliten gespeichert ist. Beim Entwerfen eines passiven System hat zwei große Probleme zu lösen: wie man eine Verjüngung und Dämpfung Momente zu schaffen.

Kombinierte Lageregelungssysteme umfassen sowohl aktive als auch passive Elemente. Aktive Elemente in diesem Fall verwenden man für die erste Senkung des Satelliten in die richtige Position, oder nimmt man solche Elemente, die keine großen Energieverbrauch und komplizierte Steuerungssystem brauchen. In der Praxis ergaben sich aktive Lageregelungen weitesten Verbreitung. Allerdings gibt es eine bestimmte Klasse von Satelliten, für die der Preis das wichtigste Kriterium ist. In diesem Fall verwenden man passive Lageregelungssysteme oder eine Kombination der Orientierungssysteme.

Für diese Klasse von Satelliten sind Vorteile von passiven Orientierungssystemen entscheidend, und Unzulänglichkeiten - nicht signifikant. Zu dieser Klasse gehören Kleinsatelliten. Das Funktionsprinzip von passiven und halbpassiven Orientierungssysteme basieren auf die Verwendung der äußerlichen Momente, die im Zusammenspiel der Elemente des Orientierungssysteme mit der gravitation-und magnetischen Felder der Erde, Luftströmung, Sonnenstrahlung entstehen, sowie auf die Verwendung von Eigenschaften schnell um die Achse der maximalen Trägheitsmomente gesponnen konstant bleiben oder fast immer

Ausrichtung der Rotationsachse gegenüber dem inertialen Raum. Je nachdem, welche Aspekte in ihrer Wirkung auf die Bewegung des Satelliten relativ zu seinem Schwerpunkt überwiegen sind, wird diese Art der Orientierung umgesetzt. Besonderheit von passiven Systemen ist die Notwendigkeit bei der Planung für eine besonders sorgfältige mathematische Modellierung.

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## **CLOUD COMPUTING – THE FUTURE WHICH IS ALREADY HERE**

Everyone is talking about “the cloud computing.” But what does it actually mean?

The term cloud computing probably comes from the use of a cloud image to represent the Internet or some large networked environment.

Cloud computing overlaps some of the concepts of distributed, grid and utility computing, however it has its own meaning if it's contextually used correctly.

Cloud service has three distinct characteristics that differentiate it from traditional hosting. It is sold on demand, typically by the minute or the hour; it is elastic – a user can have as much or as little of a service as they want at any given time; and the service is fully managed by the provider.

Cloud computing is broken down into three segments: "applications", "platforms" and "infrastructure". Each segment serves a different purpose and offers different products for businesses and individuals around the world. In the software service cloud model (applications), the vendor supplies the hardware infrastructure, the software product and interacts with the user through a front-end portal. The platform segment of cloud computing is defined as a set of software and product development tools, that are hosted on the provider's infrastructure. The final segment, known as the infrastructure, that provides virtual server instances with unique IP addresses and blocks of storage on demand. In essence this is distributed computing. An application is built using the resource from multiple services potentially from multiple locations.

Cloud computing is now associated with a higher level abstraction of the cloud. There are new services instead of there being data pipes, routers and servers. The underlying hardware and software of networking is of course still there; but now higher level service capabilities are available to build applications. Behind the services are data and compute resources. A user of the service doesn't necessarily care about how it is implemented, what technologies are used or how it's managed. Only that is to access to it and has a level of reliability necessary to meet the application requirements. Cloud computing really is accessing resources and services needed to perform functions with dynamically changing needs. An application or service developer requests access from the cloud rather than a specific endpoint or named resource. What goes on in the cloud manages multiple infrastructures across multiple organizations and consists of one or more frameworks overlaid on top of the infrastructures tying them together.

What is also important – advantages of cloud services computing. Why enterprises are or should be considering it? We can mark out five benefits of cloud computing.

1. Cheap: your IT provider will host services for multiple companies; sharing complex infrastructure is cost-efficient and you pay only for what you actually use.

2. Quick: The most basic cloud services work out of the box; for more complex software and database solutions, cloud computing allows you to skip the hardware procurement and capital expenditure phase - it's perfect for start-ups.

3. Up-to-date: Most providers constantly update their software offering, adding new features as they become available.

4. Scalable: If your business is growing fast or has seasonal spikes, you can go large quickly because cloud systems are built to cope with sharp increases in workload.

5. Mobile: Cloud services are designed to be used from a distance, so if you have a mobile workforce, your staff will have access to most of your systems on the go.

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## **ANALYSIS AUTOMATIZATION FOR ADVERTISING INVESTMENTS EFFECTIVENESS**

The challenge is to determine advertising investments effectiveness on the basis of a report on sales and a report by the investment. The following analysis method is used to solve the problem of the trend and time series seasonality.

The analysis method is based on the algorithm: we take a certain period of time, sum up the sale and determine the trend: it can be constant, increasing, decreasing. Then there is a complex process of determining the seasonal component sales: it may be absent, increase sales or reduce. Noises typically do not exceed 5 percent; then all the components are subtracted from the amount of sales for the period. The rest is a part from advertisements. The next stage is to find the recent advertisement, its early investments and descriptions are checked up, and target quality is determined.

To get all of these qualities we use statistical methods, namely time-series theory method. Various methods of smoothing and function fitting can be used for defining the trend, where a logarithmic, exponential, or (less frequently) polynomial data transformation are typically applied. For the seasonality analysis, the autocorrelated correlogram can be used which numerically and graphically shows the autocorrelated function.

Smoothing always includes the local data averaging method where nonsystematic components mutually cancel each other.

The commonest method of smoothing is *moving average* where each element of the series is replaced by either the simple or weighted average of  $n$  neighbouring elements, where  $n$  is the width of the "window".

Many monotonous time series can be adequately approximated by a linear function. If there is a clear monotonous nonlinear component, then data should be firstly converted in order to remove the nonlinearity.

Periodic and seasonal dependence (seasonality) is another common type of time series pattern. The concept was illustrated in passenger transportation. It's easy to see that every observation is very similar to the adjacent; in addition, there is a recurring seasonal pattern, which means that each observation is also similar to the observation that was available in the same month a year ago.

In general periodical dependence can be formally defined as correlational dependence of order  $k$  between each  $i$  element of the series and  $(i - k)$  elements. It can be measured by

autocorrelation (i.e. the correlation between series patterns);  $k$  is usually called the lag. If the measurement error is not too large, seasonality can be visually identified in the series as a pattern that repeats every  $k$  elements.

Seasonal time series patterns can be examined via correlograms. The correlogram displays graphically and numerically the autocorrelation function that is serial correlation coefficients for consecutive lags in a specified range of lags. Ranges of two standard errors for each lag are usually marked in correlograms but typically the autocorrelation value is more interesting than its reliability because we are usually interested only in very strong autocorrelations.

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## **NEW MOBILE NETWORKS**

Members of the public could form the backbone of powerful new mobile internet networks by carrying wearable sensors. According to researchers from Queen's, the novel sensors could create new ultra high bandwidth mobile internet infrastructures and reduce the density of mobile phone base stations.

The engineers from Queen's renowned Institute of Electronics, Communications and Information Technology (ECIT), are working on a new project based on the rapidly developing science of body centric communications.

Social benefits from the work could include vast improvements in mobile gaming and remote healthcare, along with new precision monitoring of athletes and real-time tactical training in team sports.

The researchers at ECIT are investigating how small sensors carried by members of the public, in items such as next generation smartphones, could communicate with each other to create potentially vast body-to-body networks (BBNs). The new sensors would interact to transmit data, providing 'anytime, anywhere' mobile network connectivity.

The availability of body-to-body networks could bring great social benefits, including significant healthcare improvements through the use of bodyworn sensors for the widespread, routine monitoring and treatment of illness away from medical centres. This could greatly reduce the current strain on health budgets and help make the Government's vision of healthcare at home for the elderly a reality.

If the idea takes off, BBNs could also lead to a reduction in the number of base stations needed to service mobile phone users, particularly in areas of high population density. This could help to alleviate public perceptions of adverse health associated with current networks and be more environmentally friendly due to the much lower power levels required for operation.

Dr Cotton has been awarded a prestigious joint five-year Research Fellowship by the Royal Academy of Engineering and the Engineering and Physical Research Council (EPSRC) to examine how the new technology can be harnessed to become part of everyday life.

Work at Queen's involves collaborating with national and international academic, industrial and institutional experts to develop a range of models for wireless channels required for body centric communications. These will provide a basis for the development of the antennas, wireless devices and networking standards required to make BBNs a reality.

Success in this field will not only bring major social benefits it could also bring



significant commercial rewards for those involved. Even though the market for wearable wireless sensors is still in its infancy, it is expected to grow to more than 400 million devices annually by 2014.

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### **3D TECHNOLOGY: A NEW STAGE IN TV PRODUCTION**

At the beginning of 2009, the world of 3D technology has become so popular that many TV manufacturers have rushed to this area and began developing new televisions with 3D effect. Many believed that the ability to create such televisions would last for a long time, but the popularity of 3D projects was not great and that did not give good reasons to start a massive development. Creating a large number of movies in the format of the 3D and the release of acclaimed film "Avatar" attracted attention to the 3D technologies of billions of people. Customers' needs have reached a state when the producers realized they could sell TVs with the 3D in large quantities. As a result, at this point can be seen fairly rapid development of a new direction. People are attracted to new experiences, which they get from playing stereo image. When viewing a 3D TV, the picture is not limited to height and width of the TV, there is also the depth.

Production of 3D TV was divided into two ways: one, producing TVs with the ability to view using 3D glasses, and others - with the ability to view without additional attachments, by means of which it is planned to take advantage among consumers. In fact, differences between the movies in 3D format with glasses and without them are little, since TV sets that can be watched without the glasses, there are special lenses built into the screen itself. Models in which the intended use of glasses is absent have distinctions: they use a new technology that requires no color lenses and images in different colors that will not affect the color. Glasses have become electronic and are equipped with built-in processor, which in turn "closes and opens the" left and right lens, thus forming a 3D image. They are equipped with a battery, which lasts for a long time (~ 80 hours without charge) and are connected to the TV via Bluetooth or infrared port.

Known worldwide TV manufacturers Sony, Samsung, Sharp, Philips and others have already begun the "arms race" - which is manifested in the creation of new models, new opportunities for viewing 3D movies, 3D gear. All manufacturers try to make 3D technology more accessible, we can only hope that this does not affect the quality of their products.

Contrary to the high cost of developing new technology the expected value of such products should not be high. Most likely, the price of the 3D model is not much different from the conventional TV.

Despite the promotion of 3D technologies, most buyers and manufacturers can and can not answer some questions: "How to evaluate the quality of 3D effects (what features and criteria)? What is the harm of watching 3D TV? ". There is no information about the harmfulness of stereo-display virtually, although the distortion of the angle of view is clearly present in the 3D technologies, and for some people stereo-image causes disorientation, or headaches. Many questions remain unanswered. But let us not belittle the dignity of 3D technologies, because this is a new milestone in the production of televisions.

## ROBOETHICS: FROM SCI-FI TO NOWADAYS REALITY

Robotics is rapidly becoming one of the leading fields of science and technology, so that very soon humanity is going to coexist with a totally new class of technological artifacts: robots. It will be an event rich in ethical social and economic problems.

As we make robots more intelligent and autonomous and eventually endow them with independent capability to kill people, surely we need to consider how to govern their behavior and how much freedom to accord them — so-called roboethics.

Roboethics is an applied ethics whose objective is to develop scientific/cultural/technical tools that can be shared by different social groups and beliefs. These tools aim to promote and encourage the development of robotics for the advancement of human society and to help preventing its misuse against humankind. Robotics de facto unifies the so called two cultures: science and humanities.

Advanced robots in fiction are typically programmed to handle the Three Laws in a sophisticated manner. In many stories, such as "Runaround" by Asimov, the potential and severity of all actions are weighed and a robot will break the laws as little as possible rather than do nothing at all. For example the First Law may forbid a robot from functioning as a surgeon, as that act may cause damage to a human, however Asimov's stories eventually included robot surgeons ("The Bicentennial Man" being a notable example). When robots are sophisticated enough to weigh alternatives a robot may be programmed to accept the necessity of inflicting damage during surgery in order to prevent the greater harm that would result if the surgery were not carried out, or was carried out by a more fallible human surgeon.

Specialists in robotics have postulated that Asimov's Three Laws are perfect for plotting stories but useless in real life. The first Law is fundamentally flawed in that it states that a robot cannot 'through inaction, allow a human to come to harm' which could lead to robots attempting to take control of humanity to stop them from harming themselves.

In a 2007 guest editorial in the journal *Science* on the topic of "Robot Ethics", Robert J. Sawyer argues that since the military is a major source of funding for robotic research it is unlikely such laws would be built into their designs. Indeed all attempts to govern complex robotic behavior with coded strictures may be misguided.

It's not only because robots are killing people (the first human was officially acknowledged to be killed by a robot accidentally in 1979). It's also because they have become household consumer-electronics items and because some ones now look and act like humans: Honda's *Asimo* can dance, Sony's *AIBO* has every prospect of becoming most popular pet, Mitsubishi's *Wakamaru* provides companionship to elderly and disabled people, *RoboThespian RT3* from Engineered Arts Ltd takes part in theatrical plays as full-fledged actor.

In 2007 South Korea's Ministry of Commerce Industry and Energy established a Robot Ethics Charter, which sets ethical guidelines concerning robot functions. EURON — the European Robotics Research Network — also announced plans to develop guidelines for robots in five areas: safety, security, privacy and traceability.

As robots become more integrated into human society, the importance of a legal framework for social robotics will become more obvious. Determining how to maintain a

balance between human-robot interaction and social system design will present the biggest challenges in safety when the human-robot coexistence society emerges.

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## **ECONOMIST'S ANALYTICAL FUNCTIONS IN THE ECOLOGICAL ECONOMIC MONITORING**

The monitoring system and management of an environment's ecological state is necessary for preservation a genofund and decrease in risk of population diseases. The system basis is control process over a state of environment on the basis of regional automation systems of monitoring which unite in global management system of an ecological situation in the country. The group of programmers have created system of ecological - economic monitoring.

As experts who estimate a situation and make decisions in the field of their competence ecologist, physician, economist, manager and lawyer are considered.

The economist searches the best variant according to its cost which is recommended by ecologists and physicians. For this purpose he should have data about resources which are necessary for performance of prospective actions and resources which are at the disposal of the corresponding ministries (the Ministry of emergency situations, the Ministry of health protection), local administrations, military divisions. The result of his work is definition of necessary additional resources for carrying out of actions which are offered by experts, formation of conclusions about cost of actions, possible economic expenses and sources of compensation of ecological damages. In addition he makes approximate calculation of deadlines to carry out offered actions.

The subsystem "Economist" carries out following functions:

- Display a card of area;
- Displays the chosen zone of ecological pollution to a card;
- Formation the interface for information reception about ecological, medical ,social actions and necessary resources for their carrying out;
- Formation the interface for information editing about resources and definition of additional resources which are necessary for carrying out the planned actions;
- The Reference to programs which carry out visualization of a pollution's zone;
- Formation the interface for definition and processing real zones of pollution taking into account the information about all ideal zones which are included into its structure;
- The Reference to programs which carry out economic analytical operations over a pollution zone accordingly to the list of operations over a zone.

The economist should possess the information about actual resources and prices; he considers cost of damage and actions which will be lead. In a real life there is a shortage of money, therefore due to an economist and a lawyer the final decision is accepted by the manager.

Working out of the module of forecasting is planned to keep up monetary streams and progress in work. If you use the given system, management of regions considerably will become simpler.

Ecological and economic monitoring is developed to make our life easily.

### **3-D SOUND**

It has been announced the first 3DReal Sound Home Theater Speaker System, which includes producing a completely new concept in home audio and a deeper life-like as a 3D image.

Three-dimensional graphics - a computer graphics, that has difference with the two-dimensional because it includes the construction of a geometric projection three-dimensional model of the scene on the plane with the help of programs. Although the popularity of 3D video, many companies are working on the development of this entertainment.

The international company of IT technology and Hi-Fi - LG has already exhibited this new conception of audio apparatus for home entertainment. The new HX900 utility is to reproduce the sound by modern way that creates a new effect like in the cinema during the session of a movie made by 3-D technique.

Due to volumetric image and so-called 3-D sounds the human-being has an opportunity to be in the center of events when the film is watched. The vertical sound channel allows transferring the sound to the dynamic situated on the top of sound column named Tallboy. The audio waves made by this system create an effect of presence.

The second element of the portative cinema is few double subwoofers that may stay in the opposite corners of the room where movie will be shown. Indeed, they make a strong sounding of bass, which fills the room by the volumetric sound.

The final point on the way of creating the dimensional sound is the Cinema Dome Effect. This technology based on the advanced system of digital sound adaptation helps to spread the voices either horizontal or vertical orientation by the adjustment. Consequently sound literally absorbs the listener. All three innovative technologies, combined in one product - the new home theater HX900 not only make the audio clear and powerful, they create a whole new realm of sounds the most realistic, powerful and immersive as the most spectacular 3D movies.

The home cinema HX900 propose to the user not only innovations, but also premium design. Four of its vertical columns are made in the view of parabola, which produce perfect style, with the bright details and gloss cover.

The president and The Executive Director of the corporation LG Home Entertainment Saymon Kang admits that the world of 3-D entertainment will continue to receive recognition of customers, and the new cinema HX900 is one of the examples of work in this way. "The same way as our TVs, the system of home 3-D cinema expands the horizons of indoor entertainment, making the rich, deep and exciting sound that you need to hear to believe in".

### **ARTIFICIAL INTELLIGENCE**

Artificial intelligence (AI) is the section of computational linguistics and computer science that deals with problems and tasks formalization that resemble the tasks performed by a man. AI is the technical system, which has some features of intelligence that is capable of

recognizing and understanding, finding a way to achieve results and decision-making. In practical terms, the availability of only incomplete knowledge about the brain and its operation does not interfere with its environment to build information models, digital computers and to simulate the most complex thinking processes, including creative.

At this point in the AI creation (expert systems and chess programs do not belong here) there is intense difference in all subject areas that are at least somehow related to AI in the knowledge base. The AI research has merged into the overall flow of technology singularity, such as nanotechnology, theoretical biology, quantum theories.

Some of the most impressive AI systems are the following: Deep Blue won the world chess champion; Mycin is one of the earliest expert systems that can diagnose a small set of diseases, and often just as surely as doctors; 20q is a project which was based on the idea of artificial intelligence based on the classic game "Twenty Questions" (it became very popular after the web 20q.net emergence); voice recognition systems. Systems such as ViaVoice are sufficient to service users; Jobs in the annual RoboCup tournament compete in a simplified form of football.

Banks use artificial intelligence (SSHI) in insurance activities (Actuarial Mathematics) in the market and property management. In August 2009 the work won the race of people in improvised trading on BBC News. Methods of pattern recognition, including more sophisticated and specialized and neural networks are widely used in optical and acoustic sensing (including text and voice), medical diagnostics, spam filters in air defense systems, and also in the national security.

Computer game developers have to apply AI. Standard problems of AI in games are finding a way in 2-D or 3-D space, calculation the correct economic strategy etc.

There are two directions of AI. The first is to solve the problems associated with the approach of specialized AI systems to human capabilities and their integration, which realized the nature of man. The second is to create artificial intelligence, which represents the AI systems integration already created in a single system which is capable of solving mankind problems.

In computer science problems of artificial intelligence are considered in terms of designing expert systems and knowledge bases. Under the knowledge base we mean the collection of data and inference rules that allow inference and meaningful information processing. In general, studies the problems of artificial intelligence in computer science aimed at the creation, development and operation of intelligent information systems, and issues of training of users and developers of such systems are solved by experts of information technology.

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**PREPRESS PROOFING**

A general term for a variety of options for seeing what your file will look like when printed is a proof. Proofs are used for checking that text, graphics and colors come out as expected before going to press. Proofing comes at various stages but there are specific types of proofs created during prepress and printing that allow the designer to see if their piece will come out as intended in the final printing. A prepress proof uses ink jets, dyes, overlays or

other methods to simulate the final printed piece. A press proof uses the printing plates and inks specified for the job. There are three main classifications of proofs: analog, digital and soft.

The analog proof is used as the final version approved by the customer, in which the colors of the final proof are expected to match. The analog process utilizes film negative color separations of the primary subtractive color components of the image (cyan, magenta, yellow) and black. The separations in turn are used to create separate layers containing colored toners (color key) that match closely with the primary ink colors used for printing the project. The individual layers are sandwiched together to produce the full color effect. The separation negatives are also used to create the printing plates. A digital proof is a color prepress proofing method where a job is printed from the digital file using inkjet, color laser, dye sublimation, or thermal wax print technologies to give a good approximation of what the final printed piece will look like. Digital proofs come in continuous tone and halftone proofs. Strides in color technology increasingly allow some digital proofs to serve as contract proofs. Digital proofs can often be produced on the actual paper stock of the job adding another element of accuracy. Digital proofing also includes a type of almost-WYSIWYG (What You See Is What You Get) on-screen monitor proofing or soft proofing generally only used in the early stages of production. Digital proofing is generally less expensive than other prepress proofing methods or press proofs but they aren't as accurate for checking trapping and identifying problems as overlay and laminate proofs. They are a viable option on most simple print projects and high-end digital proofs can provide even greater accuracy for more complex jobs. Soft proof describes the simulation of the print result on a monitor. The monitor used for soft proofing has to be calibrated, so that the image on the screen looks like the image on the paper. Moreover, colors on a monitor depend not only on its properties, but also on lighting conditions in a room where the image is viewed. Usually lighting is standardized and is close to a daylight. The major problem is the difference of color spaces (RGB in monitor and CMYK in print). Soft proof is a method of proofing used for simulating a raster structure of the printed image. Performing this proof makes it possible to recognize different raster-dependent effects such as smoothness, grade and range of tonal gradations, moiré or rosette patterns. This is the cheapest solution for proofing since no additional equipment, except a monitor, is needed. So, soft proofing can be used unlimited number of times.

Prepress proofing is inalienable and important part of the printing process. The analog proof remains one of the best and effective way for checking of what the final printed piece will look like. Different types of proofs are more accurate than others but with increased accuracy comes increased costs.

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## **GRID TECHNOLOGY**

The Grid concept was generated in the context of important, but as it turned out later, more narrow problem of supercomputing construction.

Grid is a new type of electronic network remotod from each other at a distance of at least 1000 km of powerful computers and research organizations. Grid goals and objectives are achieved using a special grid infrastructure, in which each element performs a specific function, and their interaction is possible via middleware. Currently there are several software

packages, such as Globus Toolkit, gLite, NorduGrid. The connection between Grid nodes can be performed by using existing fiber communication channels, which require very high standards depended on the nature of specific tasks that are solved.

The Grid system has three components: data storage resource, computing resource and special software that makes the whole system work smoothly. The grid system significance shows the following example: in 2006, research project on avian influenza has been implemented in Europe with its help. If this problem had been solved with a separate, even at that time the most powerful PC, it would have taken 150 years, and Grid pulled this task off for two weeks.

One of the main structural elements of any Grid-network is computing clusters, by which are carried out practical tasks. Clearly, a single sufficient powerful computer can be directly connected to the Grid. But experience shows that more effective solution for many research and practical tasks are just clusters because they have greater computing resources. Usually they have in its structure large devices for storage various data. Regardless of the Grid different tasks solved in the institute or laboratory where this cluster works can be calculated using them. It is essential that each organization can design its cluster according to the requirements that are determined by the research subject conducted in it. At the same time, even a small cluster has enough resources to install Grid software and can meet the requirements of this or another Grid virtual organization. Thus, the Grid system is a set of clusters, joined at fairly fast Internet connection channels. According to the terminology adopted at CERN, each cluster is the level Tier-3 Grid node, or if it is powerful enough, the level of Tier-2. Tier-2 level node can execute control functions for the regional Grid network segment, and even it can be central managing Grid node of the national Grid network.

This innovative information technology has opened the way to a fundamentally new, cooperative world science organization. Now, only a few years after the Grid idea emergence, hundreds of universities and research centers from a dozen countries combine efforts for a joint scientific issues research whose solution requires extremely large computing used constantly increasing amounts of data.

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## **ELECTRONIC PUBLISHING AND THE FUTURE OF THE BOOK**

While the term "electronic publishing" is primarily used today to refer to the current offerings of online and web-based publishers, the term has a history of being used to describe the development of new forms of production, distribution, and user interaction in regard to computer-based production of text and other interactive media.

Electronic publishing or e-Publishing includes the digital publication of e-books and electronic articles, and the development of digital libraries and catalogues. Electronic publishing has become common in scientific publishing where it has been argued that peer-reviewed paper scientific journals are in the process of being replaced by electronic publishing. Although distribution via the Internet (also known as online publishing or web publishing when in the form of a website) is nowadays strongly associated with electronic publishing, there are many non network electronic publications such as Encyclopedias on CD and DVD, as well as

technical and reference publications relied on by mobile users and others without reliable and high speed access to a network.

There is statistical evidence that electronic publishing provides wider dissemination. A number of journals have, while retaining their peer review process, established electronic versions or even moved entirely to electronic publication.

Electronic publishing has very specific non-book characteristic that distinguishes it from print publication:

- electronic publications can be produced and disseminated very rapidly - once a page of text has been coded with HTML tags it can be published immediately - the book takes much longer to produce and distribute;

- if correction is necessary, an electronic text can be updated or corrected with the same immediacy, whereas a book must either go through a second edition, or, if the error is caught in time, have an erratum slip inserted;

- electronic publication can be made collaborative and interactive, involving either several "authors" or authors and readers;

- electronic publications can be disseminated world-wide without the need for separate rights negotiations for different countries and without the costs of distribution or reprinting;

- where an electronic publication is charged for, the producer does not incur the costs associated with retail bookselling, that is, there are no "middleman" costs;

- through effective, electronic interaction with the buyer or user of an electronic publication, the producer can collect valuable market-research data very cheaply.

Electronic publishing is increasingly popular in works of fiction as well as with scientific articles. Electronic publishers are able to provide quick gratification for late-night readers, books that customers might not be able to find in standard book retailers, and books by new authors that would be unlikely to be profitable for traditional publishers.

Because of its advantages, and in spite of its disadvantages, electronic publishing is likely to replace certain categories of book and/or journal publication. The key factors that affect the probability of this happening are the possibility of rapid publication, rapid up-dating, and the economics of electronic distribution. These facts mean that electronic publishing is ideal for publishing data or information that has a limited period in which it can be put to use, which must be updated frequently, and which is directed at known, limited target audiences.

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## **INFRASTRUCTURE FOR PERSONAL SUPERCOMPUTING**

Informatics and computer science are the most rapidly developing branches of science. From the Moore's law follows that computer performance doubles every 18 month. Nowadays that's made by introducing the new multicore processors rather than increasing a clock frequency like ten years ago because at the last decade we had actually reached the physical limit for single-core processor performance and therefore a fundamental turn toward concurrent computing and multiprocessor computers have been made.

Considerable performance required for scientific tasks now is usually provided by a kind of supercomputers called clusters, principally because of the constructing ease – cluster can be built by connecting general purpose computers into a high-speed network. Theoretically



making a cluster itself doesn't require any specialized networks so anyone can make it from his home network simply by installing MPI library on every computer and enabling shell access for it, but such cluster won't have performance as high as real one. Some sophisticated problems in physics and biology require even more resources than amount can be obtained using a cluster. In these cases the grid computing is used. Simplifying, grid is a union of distributed high-performance computer resources. Mostly all really powerful supercomputers are being a part of some grid. Including a particular cluster into a grid except a legal aspects implies installation of a special software enabling grid nodes to interact transparently with each other without dependence on real location and operating aspects.

The term “middleware” is used only as cluster-related but in fact it can be installed to any computer with almost any operating system and existing resources. Connecting such a computer to the real scientific grid is not actually a really good idea but as a technique is quite interesting. It means personal computers can be connected for solving a complicated scientific problems. Approximate average utilization of a personal computer CPU is about 1%. There are approximately 200 million of personal computers in the world. Simple calculations show that their performance is at least thousand times higher than the biggest supercomputer one. And this enormous power remains unused. Using it can help to answer the general questions of mankind, fight with terrifying diseases and prevent disasters.

For enabling usage of personal computers in a distributed supercomputing the open infrastructure for network computing (BOINC) was introduced by Berkeley university specialists. Now it has about 530 000 active computers worldwide processing on average 5.5 petaflops which tops the processing power of the current fastest supercomputer system with its 2.2 petaflops. Everyone is free to join his (or her) computer to this quasi-supercomputer simply by installing a software packet. Default configuration tracks your usage of computer and performs scientific tasks only in a way preventing user from slowdowns in his work. Also anyone can set up an infrastructure server and create a distributable program for personal needs. After clients have been configured correctly to access the new server tasks or programs can be executed on just created virtual supercomputer.

Summing it all up common personal computers using mentioned infrastructure can be simply connected and operate like a virtual cluster for different tasks requiring very high performance.

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## **JAVA PROGRAMMING LANGUAGE**

Java is a programming language originally developed by James Gosling at Sun Microsystems (which is now a subsidiary of Oracle Corporation) and released in 1995 as a core component of Sun Microsystems' Java platform. The language derives much of its syntax from C and C++ but has a simpler object model and fewer low-level facilities. Java applications are typically compiled to bytecode (class file) that can run on any Java Virtual Machine (JVM) regardless of computer architecture. Java is a general-purpose, concurrent, class-based, object-oriented language that is specifically designed to have as few implementation dependencies as possible. It is intended to let application developers "write

once, run anywhere". Java is currently one of the most popular programming languages in use, and is widely used from application software to web applications.

There were five primary goals in the creation of the Java language:

- It should be "simple, object oriented, and familiar".
- It should be "robust and secure".
- It should be "architecture neutral and portable".
- It should execute with "high performance".
- It should be "interpreted, threaded, and dynamic".

Programs written in Java have a reputation for being slower and requiring more memory than those written in C. However, Java programs' execution speed improved significantly with the introduction of Just-in-time compilation in 1997/1998 for Java 1.1, the addition of language features supporting better code analysis (such as inner classes, StringBuffer class, optional assertions, etc.), and optimizations in the Java Virtual Machine itself, such as HotSpot becoming the default for Sun's JVM in 2000.

To boost even further the speed performances that can be achieved using the Java language, Systronix made JStik, a microcontroller based on the aJile Systems line of embedded Java processors. In addition, the widely used ARM family of CPUs has hardware support for executing Java bytecode through its Jazelle option.

One characteristic of Java is portability, which means that computer programs written in the Java language must run similarly on any supported hardware/operating-system platform. This is achieved by compiling the Java language code to an intermediate representation called Java bytecode, instead of directly to platform-specific machine code. Java bytecode instructions are analogous to machine code, but are intended to be interpreted by a virtual machine (VM) written specifically for the host hardware. End-users commonly use a Java Runtime Environment (JRE) installed on their own machine for standalone Java applications, or in a Web browser for Java applets. Standardized libraries provide a generic way to access host-specific features such as graphics, threading, and networking.

A major benefit of using bytecode is porting. However, the overhead of interpretation means that interpreted programs almost always run more slowly than programs compiled to native executables would. Just-in-Time compilers were introduced from an early stage that compile bytecodes to machine code during runtime. Over the years, this JVM built-in feature has been optimized to a point where the JVM's performance competes with natively compiled C code.

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## **METAL-INSULATOR-METAL DIODES**

Researchers from University of the State of Oregon have solved one of the basic problems in the field of fundamental science - they managed to find a cheap way of creation high-efficiency metal-insulator-metal (MIM) diodes.

Effectively controlling quantum mechanical tunneling through an ultrathin dielectric represents a fundamental materials challenge in the quest for high-performance MIM diodes. Such diodes are the basis for alternative approaches to conventional thin-film transistor

technologies for large-area information displays various types of hot electron transistors, ultrahigh speed discrete or antenna-coupled detectors and optical rectennas. MIM diodes have been fabricated by anodization, thermal oxidation, plasma oxidation or plasma nitridation of crystalline metal films. Diodes fabricated using these approaches have invariably exhibited poor yield and performance. These problems are to a large extent a consequence of the roughness of the surface of the crystalline metal film, which is often larger than the thickness of the MIM insulator. As a result, the electric field across a MIM device will be highly nonuniform, making the control of quantum mechanical tunneling problematic.

The MIM diode is the fundamental building block of metal-insulator electronics. The device is characterized by a high degree of nonlinearity in its current-voltage characteristics as a result of a large difference in conductivity between on and off states. The operational theory of this diode, based on Fowler-Nordheim tunneling, has been described in detail by Simmons. The probability of quantum mechanical tunneling depends exponentially on the thickness of the insulator between a pair of metal electrodes. Hence, the performance of the diode is critically dependent on the thickness uniformity of the tunnel-dielectric layer across the entire device. Interfacial roughness and dielectric imperfections give rise to alternate conduction mechanisms, e.g. Frenkel Poole emission, that can dominate at low voltages and reduce the device rectification ratio. The inability to create and effectively control a uniform electric field across the whole device area has been the primary limitation in producing reliable MIM devices. The necessary field control can readily be achieved by integrating the atomically smooth-surface of an amorphous metal electrode with high-quality insulators. This combination provides a rich materials and processing palette for development of MIM electronics, enabling new strategies for device design and fabrication.

Now scientists of university lead certain preliminary work on application of new technology in electronic displays, but it, for certain, will find set of other applications. In particular, there is possible a creation of high-speed computers which are not limited by possibilities of transistors. Also occurrence of the systems collecting energy, for example radiated a terrestrial surface at the night is possible. The American physics say, that the technology is compatible to readily available metals (copper, nickel, aluminum). It is supposed, that schemes on a basis of the MIM diodes can be cheaper, rather than present chips on the basis of silicon. Herewith the press of new schemes on large substrates from a different material is possible. The new technology, probably, becomes new way of fast manufacturing of cheap electronics in huge scale.