FITCE Forum

53rd FITCE Congress in Naples, Italy - well on track.

Naples FITCE 2014.   Congress Website.

"From Network Infrastructures to Network Fabric: Revolution at the Edges".

Message from the President.

Dear Fitce friends,

Organization of this year 53rd FITCE International Congress is entrusted to the Italian Association AICT. They have prepared this event together with Greek and Spanish FITCE Associations in the formula of their mutual cooperation activity in the Mediterranean European region.

This new formula called Euro Med (-iterranean) Telco Forum is especially interesting as it is also addressing boundaries beyond southern Europe. While in our Federation of FITCE we are in the process of "new FITCE", implementation this regional attempt seems attractive and promising.

Wojciech Halka
FITCE President

Moreover, the subject of this 53rd FITCE Congress, turns our attention to the new and challenging phenomenon of raising connectivity of terminal equipment in telecommunication networks. More and more, the users of telecommunication services will connect their equipment to more than one single network and will multiply accessibility of their terminals. This will open new prospects for the owners of network infrastructure, operating companies and service providers.

All Congress' meetings and presentations will take place in the Conference Centre of the University of Naples, located on the nice banks of the Mediterranean sea. This beautiful and historical place will in addition host our yearly meeting.

Dear friends, firstly we expect your professional satisfaction from the visit to Naples this year, but secondly, we do expect your stay in this city to be a pleasant and interesting one, because of the many unique tourist attractions. We invite you to the 53rd FITCE Congress in Naples and appreciate very much the opportunity of meeting you this year in Italy.

See you soon at the Congress in Naples.

Wojciech Hałka
President of FITCE.

Welcome to Naples.

Maurizio Mayer
Congress Chairman.

As Congress Chairman, I wish to welcome delegates of the Euro Med Telco Conference 2014 to the historic city of Naples. The Euro Med Telco Conference 2014 doubles up as the 53rd edition of the annual Fitce International Congress and the first open event organized by the Euro Med Telco Forum (EMTF). Fitce is the well known Federation of the Telecommunications Engineers of the European Union while EMTF is a platform founded by the Greek, Italian and Spanish

Naples at Sunset.

Contents.

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Fitce branches that aims to extend the ICT cultural activities beyond the European boundaries to reach all the Mediterranean area. The Naples choice for this first edition wants to be a clear geographical sign in this direction.

The Conference will be hosted by the University of Naples Federico II Congress Centre in Via Partenope on the sea side just in front of the magnificent Castel dell'Ovo .

University of Naples Federico II Congress Centre

We believe that a strong contribution to the economic and social progress of this wide area may come from the last advances and wide distribution of the latest ICT researches and related applications. For this reason we have chosen a subject for the scientific and technical sessions in line with the most recent developments and market trends: in fact in these last few years we have seen a growth in the local networks, wifi, bluetooth, sensors' networks. We have also seen several constituencies setting up their local networks, like in malls, airports. Some of these are actually city wide, set up by Municipalities.

Castel dell'Ovo

In the coming years we are going to see further deployment of these networks as well as of halo nets created by terminals themselves, like a cell phone creating a local network that can be used by a variety of devices to connect to the big infrastructure and with one another.

This is leading to a revolution at the edges, supporting the connectivity at ambient level and decoupling the end user from the main infrastructure. Actually, we are also seeing double SIM cell phones that can connect to two Operators networks and the advent of the Soft SIM is likely to multiply the access option for a terminal. All of this tells us that we are moving in terms of the end user from a single Network Infrastructure to a Network Fabric.

Piazza del Plebiscito

Clearly this has significant implication for the Operators that by 2015 in Europe will find their own market space populated by all other European Cell Phone Operators: an increase in connectivity options from a few to over a hundred!

This connectivity fabric will also provide major opportunities to many partners making the Internet of Things more and more feasible.

Beside the technical program we will have round tables regarding interesting topics related to the diffusion of these techniques, like: Do we need a Digital Agenda for the Mediterranean?

We therefore invite all the ICT community in and outside the Euro Mediterranean area to contribute and participate to this new initiative.

Maurizio Mayer.
General Chair.
FITCE Congress 2014.

Congress Technical Program.

The following Congress Technical Program will be updated from time to time. The most up to date program will be at the Congress Website.

Wednesday	12-11-2014	
15:00	19:00	Registration is open
19:30	21:00	*Welcome cocktail*

Thursday	13-11-2014	
09:30	10:30	Welcome Addresses
10:30	11:00	Key note speech: "From network infrastructures to network fabric". Antonio Manzalini (Telecom Italia & IEEE)
11:00	11:30	*coffee break*
11:30	13:00	Round Table: "Digital Agenda for the Mediterranean?"
13:00	14:30	*Lunch*
14:30	16:00	Technical session 1: Mobile, Wireless and Satellite Networks 1
14:30	16:00	Technical session 3: Smart Cities 1
16:00	16:30	*coffee break*
16:30	18:00	Technical session 2: Mobile, Wireless and Satellite Networks 2
16:30	18:00	Technical session 4: Platforms, Applications & Services 1

Friday	14-11-2014	
08:30	18:00	Registration is open
09:30	11:00	Technical session 5: Mobile, Wireless and Satellite Networks 3
09:30	11:00	Technical session 8: Internet of Things (IoT)
11:00	11:30	*coffee break*
11:30	13:00	Technical session 6: Platforms, Applications & Services 2
11:30	13:00	Technical session 9: Networks Infrastructures 1
13:00	14:30	*lunch*
14:30	16:00	Round Table: "Networks, Services and Markets"
14:30	16:00	Technical session 10: Networks Infrastructures 2
16:00	16:30	*coffee break*
16:30	18:00	Technical session 7: Networks Infrastructures 3
16:30	18:00	Technical session 11: Smart Cities 2
21:00	24:00	*Gala Dinner*

Saturday	15-11-2014	
10:00	11:30	FITCE General Assembly
11:30	13:00	Congress Conclusions

Partners Program. FITCE 2014.

The Partners Programme will include invitation to the Welcome Cocktails, Lunches and Coffee breaks of the main Congress. There will also be a visit to Naples by Bus and foot on Thursday Afternoon starting 14:30. A visit to see Pompeii is being planned for Friday starting 9:30. More details will be made available on the website.

Report of the 3rd Greek-Italian-Spanish workshop.

A workshop took place in Athens Greece on the 20th of June 2014 that was co-organized by the FITCE Organizations of Greece, Italy and Spain. The workshop, ''Growth and ICT: ''The Future in the Mediterranean region'', was focused on current trends and innovations in the field of ICT. The speakers that came from different fields and professions from the above countries including Israel covered a large area of topics from the telecoms and informatics areas. Around 140 participants attended and gained a vast experience and knowledge in various topics of contemporary topics.

Among the speakers were the vice president of the Regulatory office of Greece, the General Manager of the Greek Mobile Association, the Director of the Data Protection Authority in Greece, two Professors from Greek Universities, members from the board of Spanish Telecommunication Association, the Manager of Corporate Affairs from Israel and other key presenters from the ICT public and private sector of Greece and Italy.

The three sessions were concentrated in the fields of access technologies and next generation technologies, digital agenda, cloud services & internet of things, critical infrastructures, security and data privacy.

A round table brought together professionals from the participating countries of the Mediterranean region that exalted the interest of the delegates of the meeting with their interesting thoughts and ideas of enhancing the cooperation of the European southern community.

Everyone admitted the success of the workshop and promised to motivate the participation of more Mediterranean countries in the future.

The morning before the workshop started with a visit to the Acropolis Museum, one of the luxurious archaeological sites of Greece which is filled with artifacts excavated and found on the nearby Acropolis, Athens' iconic hill that overlooks the city.

The workshop closed with buffet accompanied by a lovely jazz live music.

An Infinity of Clouds

Peter Cochrane (Cochrane Associates UK).

PROLOGUE

In less than 25 years the internet has become an indispensable part of our civilisation with over 90% of peoples in the developed world and 30% in the developing world now regular users. The precise numbers of people and things served by today's internet is estimated to be around 6Bn, and the most modest forecasts suggest a quadrupling of 'things online' to 15Bn by 2015 and over 17Bn by 2017.

The only thing we know for certain is the growth patterns are all exponential, relentless, and soon expected to see a greater than 50-fold expansion [1]. But the biggest and most impactive transition is the migration to a world dominated by things on-line. Estimates vary, but we expect somewhere between 50 and 250Bn things on-line within the next 5 to 20 years (see Figure 1). So the $64k question is: Can the internet of today support such a mixed community? The answer has to be: No! It is physically and economically unable to meet our needs should more than 7Bn people move onto the net let alone an additional population of things far exceeding humanity. How come? Telephone network growth follows an N2 law where N = the number of nodes. On the other hand, the internet grows a 2N. So expanding the internet by more than 10 to 100 times its present size would see a scaling by over 210 to 2100 which is a massive 1024 to (1024)10

We are thus faced with one, and only one viable option: The Cloud ! However, this is not a singular entity, but a plurality of (cloud) networks rich in species, types and form providing a far greater degree of economy, inherent stability, resilience and security. It also promises to invoke changes in the way people, companies, industries and nations operate and trade, including significant contributions to a sustainable future. Why this should be the case is partially explained by the relatively 'local nature' of communication and file transfers.
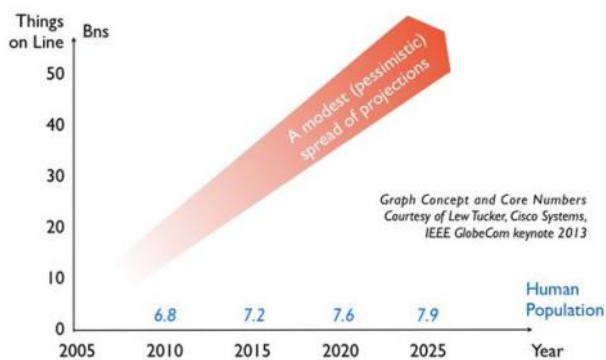

Fig 1:Projected Cloud growth.

AXIOMATIC INEFFICIENCIES.

An alien visiting this planet might be forgiven for thinking the internet is no more than a bigger and more chaotic telephone network. Whilst packets and routing have, by and large, replaced locked down direct A to B (circuit switched) connections, the topology remains the same with everything still connected (by wire and wireless) to major switching nodes tree and branch fashion. However, the routings are now far more extreme. Whilst two people in a town or city might have connected by a 2 to 5km hop in the days of the telephone, each of the 'packets' of the internet may now find their way via 2 to 100km or more depending on the network loading. To say the least routings can appear bizarre [2].

The hidden cost of such a network becomes clear when we total the energy consumed for the internet which has been variously estimated to be between 3 and 5% of global energy production, and does not include our fixed/mobile devices and connected things [3]. This figure will grow exponentially if we expand to over 50bn things by a massive factor of much greater than 1024. There is just not enough energy on the planet to support such a network on the basis of today's network technology and topology! So, how will Clouds (plural) help?

Suppose you and I are in a coffee shop using our own private cloud, or that provided by the shop, and I want to send you a file or message. Why traverse some distant node when the information interchange can be completed locally. Suppose cars on a highway need a traffic update of what's up ahead. Why go into a central network when the data can hop car to car and propagate front to back along the flow of vehicles? An accident or incident could be detected and reported faster this way than through any centralised network [4].

The Cloud, Clouds, and Things will also embody a degree of intelligence and protocols that minimise the energy/byte communicated to resemble more of a biological than a mechanistic entity. Exactly why and how this should be becomes more apparent as we dig deeper into form, variety and projected usage. But we should also note that Clouds and Cloud computing are evolving in a similar manner to the internet before - including form, services, and standards.

The key here is not one big 'do it all network' but a myriad of small but linked 'Clouds' that minimise energy, hardware, latency and usage. In effect we have to decimate the scale problem into a large number of independent, but scalable, entities that consume far less than the projected 'internet hole'. This is perhaps best visualised by considering the energy to convey packets over 3G network where the span is 10km compared to wifi or BlueTooth when the span is 5m (see Figure 2). In short; the Watts and mW demanded are scaled down to uW! It is important to recognise that we are not the first to do this; Mother Nature has been organising neural networks and brains in the way for billions of years. No tree and branch; more 'cluster' and branch.

'You don't put all the brains in the head of a dog'
'Nervous systems employ distributed sensors, actuators and processing centres'

Fig 2. :Spontaneous Cloud of smart devices affording greater scalability

HIDDEN RELATIONSHIPS

As a general rule we, as a species, like simplicity, and if something is complex, we do everything to reduce it down to its simplest form. In a slow moving disconnected world this worked well, but in the fast-paced and highly connected world of today, such myopic thinking turns out to be very risky and often dangerous. A good example of this is the coupling between markets and politics. A misguided or unthinking word from a minister can crash a market. Or indeed; the threat of military action or cessation of hostilities can enable or wreck the supply industries; adverse publicity in the press can cause irrational and unexpected mayhem for the health system; service demands created by a sporting event can crash mobile networks and heavily peak energy demands in the home and so on.

Consider some of big changes and technologies (an incomplete but expanding listing) that are very definitely connected, but mostly considered one at a time:

(1) Apps   Open Everything (5) create huge data flows that lead to (2)
(2) Big Data   Information beyond human scale/ability demands AI (7)
(3) The Cloud   Invoked by limits of scale driven by (1, 2, 5, 6, 8 - 13)
(4) Thin clients Driven by need for more at less power (1 - 4, 6 -13)
(5) Open everything   Freedom invoke creativity and prosperity (1,12)
(6) Security/cyber crime   Demands the degrees of freedom of Clouds (3)
(7) AI (Artificial Intelligence)   Created to overcome human limitations (1, 2)
(8) BMOB (Be My Own Boss)   Encouraged & invoked by the rise of (5, 9)
(9) BYOD (Bring Your Own Device)   Invoked by (1, 3, 4, 5, 7, 10 - 13)
(10) Divergence(there is no convergence)
(11) WiFi dominance over mobile networks
(12) The rise of mobility and advances of creativity
(13) The abandonment of wired LANs and wireless dominance
(14) ....

A moments thought reveals the casualty for most of the list, but the connection and relationship of some components is not so obvious. For example: effective AI systems demand sensors and connectivity with things, systems, data banks, and people. In fact, these furnish a greater component of true intelligence than processing power and raw memory [5]. The link and dependency on (1) to (5) above is thus very clear. But then AI as a tool and servant of humanity impacts directly on (7) and (8), and in turn is further enhanced by (9). Nothing is isolated, nothing is disconnected, and everything and everyone benefits.

CLOUD SPECIES

As of today we can map out a considerable but incomplete future for Clouds (see Figure 3). They already appear on chip, card, shelf, rack, floor, building, campus, village, town, city, region, continent, on and off planet. Also, we see personal, private, public, open, closed, secure, insecure, company, commercial, institutional, educational, governmental, military, medical and more. Then of course there are fixed, mobile, permanent, transient, opportunistic, singular and plural. Furthermore the technologies in use are equally varied spanning: ZigBee, Bluetooth, WiFi, WiMmax, 3G, 4G, InfraRed. And we can confidently expect that new additions to this listing will arrive over the next decades including 60, 90, 120 and 180GHz solutions furnishing massive data transfer capacities over short and very short distances [6].

Scale / Reach	Characteristics
Femto = On chip	Fixed
Nano = Chip to chip	Mobile
Micro = Device to device-to-device	Transient
Local = In a room / building	Permanent
Campus = Spanning a site	Commercial
Urban = Spanning a town	Government
Region = Spanning part of or an entire country	Invisible
Continental = Spanning the biggest land masses	Visible
Global = Spanning the planet	Private
Cosmic = off planet	Public
	Closed
	Open

Fig 3. :Notional Cloud classification

This all conjures an interesting world far removed from yesterday and today. When the wireless revolution started over 100 years ago there were a few hundred (big - fork lift) transmitters and thousands of receivers spanning thousands of kilometres. Just yesterday we had thousands of big transmitters, and billions of receivers spanning tens of kilometres. Today the dominant distances are much shorter, and in Clouds we will see the majority less than 10m.

Many, or even most, of the things online will have inbuilt intelligence and a growing record of their origin - probably including: material sourcing, design, manufacture, sale, ownership and use through to reuse, repurposing and recycling. Just how intelligent is impossible to predict, but we only have to consider insect communities like ants to contemplate the complex behaviours exhibited by apparently primitive animals living in large networked (by pheromone) community. In fact, the similarity between Clouds of Intelligent Things (see Figure 4) and Mother Nature may turn out to be more profound than we might anticipate.

(Continued from page 6)

Mass produced goods and consumables in their billions (of very low value) are most likely to be 'simple minded' whilst the complex and expensive items produced by the millions and thousands are likely to be far more intelligent. In this 'eco-system' it is also likely that a 'pecking order' will evolve based upon position on the 'intelligence scale'.

In the biological world every intelligent entity on this planet seeks to sense and communicate. Why should the silicon world we are building be any different ?

Fig 4. :The end game will most likely see a 'networked society of intelligent things'

Exactly how all this will actually pan out is unclear, but what we might reasonably assume is that it will ape nature with distributed intelligences sharing sensory information and memory. Another way of looking at this is to see 'everything on line' as the ultimate sensor/sensory network. And in the equation of intelligence, sensors represent a very big and important component compared to raw processing power and memory.

EVERYTHING AS A SERVICE

The notion of everything from hosting, networks, storage, processing, connectivity, apps et al as a service is now well established. But more recently ' artificial intelligence' has been added to the list with IBM Watson . This is a potential game changer for every industry and profession demonstrated by the inroads made into medical diagnosis, treatment and prognosis. We might thus anticipate future clouds furnishing us with; automated care, investment banking, brokerage, legal advice, technical advice and support plus business services including accountancy, analysis and decision support et al as a service on our laptops, tablets and mobiles.

The impact of all this is incalculable but will most likely eclipse the contribution of the internet as per the telephone network and the telegraph before.

In the same way Clouds are rescuing us from the inability of the internet to support humanity into the future, it turns out that 'things on line' are a vital element to a greener future. A full knowledge of everything manufactured, grown, produced and consumed is essential to a future where we obviate material destruction, underuse, over capacity, over capability, downtime and waste. And we have no option but to adopt such an

approach if we are to realise an equitable standard of living for all peoples.

We have to stop producing more and more for the few and start supplying sufficient for the many.

AMPLIFIED SECURITY

Today's internet is a heaven-sent opportunistic playground built for the hoody crouched over a laptop in a bedroom, organised crime and the rogue state [7]. Every server and company web site is named and guarded by ineffective firewalls, malware filters and wide open to the fallibility of employees and contractors. Best of all, everything is nicely laid out, tabulated and identifiable with sections and folders assigned names like: Personnel, Finance, Order Book, Production Schedule, Customer Details, Patents and Intellectual Property etc. Could we make it any easier for The Dark Side ?

Add to all this a business world dominated by a single operating system and application set, a very limited number of equipment and software producers, a limited number of internet service providers, and networks using the same or similar hardware, topologies, configurations and software, and it is hard to think of anything more we could have done to amplify the risk confronting individuals, companies and countries! Now add to this the risks associated by the poor management of outsourcing, temporary staffing, and contractors [8]. Then of course this is all compounded by smartphones, laptops, tablets and network equipment predominantly manufactured and supplied by a very few companies in one region. You don't have to be a genius to work out that there are likely to be quite a few back doors and access points built in and ready to go before you get these items out of their box!

So how is The Cloud going to make any difference and improve the situation ? In short; a huge increase in the degrees of freedom to be exploited by us and not the enemy make it all inherently more secure and far more flexible than any medium we have yet devised, but only if we think and do differently! If we continue to behave and do as we have in the past we will certainly miss a large percentage of the security amplification on offer.

Let's examine exactly how substantial advantages will be realised at the level of an individual. Today we can get anywhere between 2 and 50GB of 'free to use' Cloud storage from a number of the big and small players. So when you want to store a document you no longer have load it onto a single server, instead you can parse into (say) ten regular or irregularly sized sections and scatter it around ten diverse servers in ten different countries. If you wish you can encrypt the document before and/or after parsing, and to be even more devious, you don't have to use the same key each time. Where, when, and how each of these 'deposits' is enacted can also be varied! By these mechanisms; structure, form, habit and predictability have been destroyed or disguised (see Figure 5).

Company, institution or government are also seeing more degrees of freedom and the ability to secure documents is amplified way beyond the above 'personal' case. For example; concatenating an open public cloud with a closed/

invisible series, each with different keys, is one obvious option. However, this can be rendered even more perverse by randomising the ports on every entry, and never repeating key or port identifiers.

And now it gets even better:

- Clouds spanning short, medium or long distances can be spontaneously formed, organised, used and closed down spontaneously before intruders have time to detect their existence and gain access

- Naming can be randomised, obscure and of any form (logical and/or illogical) and predictable paths can be removed, concealed or used and obliterated - the obvious analogue of this url hopping would be frequency hopping is spread spectrum

- Hierarchy and any obvious structure can be disguised, hidden or even be non-existent – it is no longer important or of any significant value

- Addressing, passwords, protocols do not have to be the same, repeated, similar or follow any form of logical pattern or relationship

- Encryption seeds, passwords, and logon procedures can be dynamic and never the same twice

- Multiple Cloud accounts and providers can be randomly selected and varied continuously

- Being in a cloud doesn't always mean being connected to the internet

- ISPs, location and mode of connection can be varied continuously

- A combination of on and off-grid, open, closed, visible, invisible, public, and corporate clouds can be employed

- Decoy clouds, spoof data, honey pots, and elephant pits can also be deployed
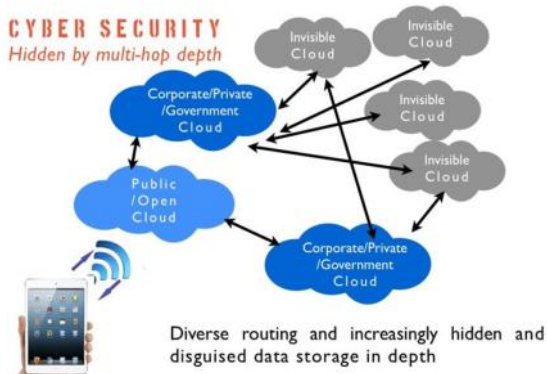

Fig 5. :Clouds can be devious with hidden defence in depth and diversity

The Dark Side loves order, conformity, patterns, repetitive actions, rules, regulations, protocols; in fact, any element of standardisation and predictability. It is as good as giving them the keys to the kingdom, and Clouds can take away/nullify any such opportunities.

There is also a big opportunity to dissipate the energies of The Dark Side by purposely providing spoof, ghost and decoy sites. All we have to do is apply a little imagination and energy and security can be vastly improved!

The basic rules for a Cloudy future follows those established for any form of warfare:-

- Moving targets are harder to hit

- Predictable behaviour increases risk

- Don't be obvious, hide, use camouflage

- Strike first, move fast, leverage surprise

- Know you friends, but know your enemies better

- Decoys, false moves, and confusion are your friend

And so on; it is all in The Art of War (Sun Tzu circa 500BC).

EXEMPLAR SCENARIO

You leave home with your laptop, mobile and wearable all connected by a 'Body Cloud' and journey by public transport to meet with two other members of your work group in a coffee shop. On the way your devices continually scan other 'Body Transport, Office, Home, City and Regional Clouds' to collect any upgrades, security briefings and shares. When you arrive at the coffee shop this scanning process continues!

After a brief discussion and graphic demo the three of you form a 'Group Cloud' to share data and interact on a system model and management scheme you are jointly designing. This demands lot of computing power and you have to simultaneously task all three laptops to orchestrate a 'virtual supercomputer' plus an 'AI support machine' in the USA via a 'Public Cloud' via a secure path provided by the project client hosting centre. After 30 minutes the tasks are completed, files are shared and all Cloud links are cut.

During this session a number of alerts and briefings arrived on your machine to be automatically checked for veracity and malware before sharing with your colleagues. Clean 'Alert Copies' are also deposited with the 'Public Cloud' for others in the immediate vicinity to benefit. You all depart the coffee shop and the cycle continues…

FINAL THOUGHTS

Predicting technological futures 5 to 10 years out, the systems and modes of operations we might adopt, and the potential disruption to the business world and our lives in general is reasonably straightforward, but predicting what people will actually do turns out to be near impossible. However, on the security front people are always the biggest risk; they break the rules, use unapproved hardware and software and 'click' on bogus sites. They leave passwords on post-it notes, discarded hard drives, lose USB drives, accept dubious IT gifts, are prone to loose talk and the odd 'work around' of network protocols and firewalls, and so on!

Much of this is nullified by outsourced clouds and BYOD (Bring Your Own Device) compounded by the variability of

'user owned' devices, operating systems, apps, security software, configurations, access points, transient modes, multiple fire walls, detectors and traps, et al. But the biggest advance to come is the intelligent and 'near real time' sharing of attack data and fixes device-to-device, network-to-network, server-to-server, cloud-to-cloud. Detect an intruder or attacker somewhere and immediately share that information with every network, server and device on the planet provides an incredible strong defence protocol even more viral than the attack. And it might even turn out to be more effective than the biological immune systems found in the most complex of organisms!

For decades we have passively suffered the attacks, inconveniences and costs imposed by a few evil-minded people and state sponsored vandalisms. It might just be that Clouds and Cloud computing mark a turning point, and a low cost, but very effective fight back.

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PAPER SYNOPSIS.

Over 90% of peoples in the developed world and 30% in the developing world now regular users of the internet. But the biggest transition is yet to come - to a world dominated by things on-line. Forecasts suggesting a quadrupling to 15Bn by 2015 and to somewhere between 50 and 250Bn within the next 5 to 20 years. Today's internet will not cope with this. The only viable option is the Cloud – not a singular entity, but a plurality of (cloud) networks rich in species, types and form providing a far greater degree of economy, stability, resilience and security. This article expands on this paradigm.

Network topology has hardly changed over the years with everything still connected to major switching nodes in a tree-and-branch fashion. However, the routings are now far more extreme with each IP packet being routed 10s or 100s kilometres irrespective of the proximity of the end points. By carrying on like this, the energy consumption alone, currently estimated to be 3-5% of global energy production, will break us. There is just not enough energy on the planet to power a network based on today's network technology and topology if we expand to 50Bn things on-line.

The key is not one big 'do it all network' but a myriad of independent, small but scalable and linked 'Clouds'. There will be many cloud species and characteristics from physical size (chip, card, ... planet), to usage type (personal, secure, open, company, ...), to temporal (fixed, permanent, transient, …), to technology type (Bluetooth, 4G, …). Today's internet is a heaven-sent opportunity for criminal activity. Every server and web site is named, guarded by ineffective firewalls, and open to the fallibility of people. Everything is nicely ordered, with folders names like: Personnel, Finance, Order Book, etc. The business world is dominated by a single operating system. There are a limited number of equipment and software producers. Networks use the same basic design. Devices and network equipment are manufactured by a very few companies in one region. It is hard to think of anything more we could have done to amplify the risks. The Dark Side loves order, conformity, patterns, repetitive actions, rules, regulations, protocols; in fact, any element of standardisation and predictability.

So how is The Cloud going to make any difference and improve the situation? In short; a huge increase in the degrees of freedom to be exploited by us and not the enemy make it inherently more secure and more flexible than any medium yet devised, but only if we think and do differently!

Even today, as individual consumers we can get up to 50GB of 'free to use' Cloud storage. Sensitive files could be parsed into regular or irregular sized sections, scattered around ten diverse servers in ten different countries. The file could be encrypted before and after parsing using different keys. Structure, habit and predictability have been destroyed or disguised. Companies and institutions have even more scope for randomising information. With an infinity of clouds, the opportunities are much better. Clouds can be spontaneously formed, organised, used and closed down before intruders have time to detect their existence. Naming can be randomised. Hierarchy and any obvious structure can be disguised, or even be non-existent. Encryption seeds, passwords, and logon procedures can be dynamic. Multiple Cloud accounts and providers can be randomly selected and varied continuously.

Predicting technological futures 5 to 10 years out is reasonably straightforward but predicting what people will actually do turns out to be near impossible. However, on the security front people are always the biggest risk. Much of this is nullified by outsourced clouds and BYOD (Bring Your Own Device) compounded by the variability of 'user owned' devices, operating systems, apps, et al. But the biggest advance to come is the intelligent and 'near real time' sharing of attack data and fixes - device-to-

device, network-to-network, server-to-server, cloud-to-cloud. Detect an attacker somewhere and immediately share that information with every network, server and device.

For decades we have suffered the inconveniences and costs imposed by successful attacks; it might just be that Clouds and Cloud computing mark a turning point, and a low cost, but very effective fight back.

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