Integrated Communication Dynamics and Manifestation as Robust Platform for Accurate Decision Making in the Armed Forces

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PREAMBLE:

i.   **BACKDROP**.   Over the years; satellite, smart phones with cameras, and IP phones have been added to the communication mix. Sequentially, the function of interoperability systems has grown to support multi-user conferencing across the entire spectrum of communication devices as well as to capitalize on 3G and 4G technologies to operationally perform in a theatre-of-action, alongside integrated voice, video and data. Consequently, it is not only possible through edge of technology gateways to set up 24x7 situational awareness but also provide, seamless echelon connectivity for rapid collaborative response in a customized, cost effective and efficient manner; in any hierarchical or flat order as required! The representation of such communication mix on a geospatial platform augments commanders to understand the element matrix of communication.

ii. **PEACE TIME COMMUNICATION**.   The need for communication interoperability for a variety of military, homeland, defense, emergency communications and disaster management applications is well established. This paper presents simple and quickly deployable solutions for communication interoperability. It is an efficient, feature-rich, scalable, and easy to administer communication gateway. Before any further discussion on the gateways per-se, it is advisable to understand the myriad challenges inherent in the operating environment.

iii. **COMMAND & CONTROL – COMMUNICATION & COORDINATION**.   Command and Control structure in the Armed Forces is practically synonymous to Coordination and Communication. The nature of operations, exchange of iterative information, situation reports and intelligence for rapid, optimal decision cycle are intrinsic decision drivers. One of the prime needs is to make the Decision Chain agnostic to individual personnel changes, and provide continuity & constancy of decision flow. The Force having robust command and Control structure turns out to be a well managed and well-oiled force. Command effectiveness of any force depends on its vision, flexibility to imbibe technology and induct equipment to suit operational and peace time training/ tutoring requirements. A Vigorous Communication highway is mandatory for a robust Control structure. Mapping the communication highway to Geospatial platform will augment planning and designing of command and control structure of Armed Forces; there is a priority need to render the control and coordination chain to be effective and efficiently responsive through sound communication system. Armed Forces could leverage the technological advances made in the industry to enhance the Control and coordination element at par with the Command structure. This can be even done within the Armed Forces in cost and time effective manner. This paper seeks to apprise, orient the senior management on the force multiplier advantages, the facile nature of its implementation and the ease of its absorption by all echelons of Armed Forces worldwide for both operational, aid to civil power and disaster management contingencies. It may be noted that this paper does not seek to replace any ongoing modernization plans of Armed Forces in the area of communications and in fact, the aspects highlighted in this paper would become naturally complementary and be absorbed into the existing arrangements held with respective Armed Forces across the globe.

Keywords – *Armed Forces, Communication dynamics, Decision making, Situational awareness, communication architecture, communication framework, Military operational bubble and Android based communication.*

1. INTRODUCTION:

Optimising Armed Forces's Command, Control through effective coordination and facile communication is the need of today and future as well. The Communication architecture in the Armed Forces is generally through a combination of Static and dynamic networks. While the backbone connectivity during peace time is through Static Communication Networks, using OFC and Microwave links, the field time Communication is mostly through dynamic network using radio media. The static connectivity though is successfully extended to Armed Forces Wide Area Networks, the dependence on singular civil/ commercial agencies does inhibit robustness desired in a military Communication network.

2. NECESSITIES FOR A ROBUST COMMUNICATION FRAMEWORK:

2.1 GAPS FOR IMPROVEMENT IN THE COMMUNICATION ARCHITECTURE:

The capability of a Commander enhances manifold with the Communication framework available at his disposal. The current Communication network could be made operationally optimal in terms of coordination and communication. It would also make the commander have direct access reach. This will enable a holistic overview combining secondary and tertiary inputs rationalized by first hand 24 x 7 Situational Awareness inputs. This could be implemented without causing any changes to existing security infrastructure. This could be easily installed and operated by any untrained soldier.

2.2 DEVELOPMENT IN THE TECHNOLOGY ACROSS THE GLOBE:

Communication across the globe has seen technological advances through induction of Sat-phones, remote communications, wi-fi and wi-max networks. The tablet based android dependent hardware devices with open systems have revolutionalised the entire Communication milieu. Advanced countries in the world have leveraged commercially available Communication networks to augment existing Communication structure of their respective Armies. Tactical Communication Systems of Armed forces of entire world would be in synchronization with the broad concepts of this paper. Till each Country plans for a robust dedicated network for their respective Armed Forces, Armed Forces could cost effectively adapt, adopt and customize some of the advance technology readily available and that too as positive preemptive value add-ons to their future network systems. The efforts to indigenize such technology, alongside suitable organization, infrastructure and products could be undertaken even within the Armed Forces through planning of Concepts, design blue print through prototype development and field testing. Armed Forces R&D infrastructure can work with respective Government agencies, subsequently for production. The entire gamut would also be financially viable and can be achieved on war footing for Armed Forces to benefit.

2.3 OPERATIONAL VALUE AND NECESSITY OF MOBILE COMMUNICATION FRAMEWORK:

This paper highlights ways and means of maximizing existing static networks and enhancing the integral value of Tactical systems that are likely to be planned by all the Armed Forces subsequently. The principle philosophy of approach is centered on the following:-

2.3.1 A Cost effective blend between legacy systems and operational communication requirements/ situational awareness requirements.

2.3.2 In effect, no replacement of radio equipment is needed to effect this change. Even obsolescent replacements can be integrated through the proposed bridging and performance enhancing systems.

2.3.3 The absorption capability of latest technologies could be exploited/ utilized for life of cycle of performance matrices.

2.3.4 The perennially needed 24x7 situational awareness inputs would be available for operations, training, operational logistics and administrative needs.

2.3.5 Simulations through war-gaming and table top exercises could also be made very practical in this medium.

2.4 METHODOLOGIES TO OPTIMISE THE COMMUNICATION ARCHITECTURE:

The genesis of this paper resides in its proposals to enable Armed Forces acquire an Operational edge of 24x7 situational awareness through a bridge between legacy and advances communication conduits, blend usage of android cellular phones, tablets, with existing communication equipment and maximise functioning of existing static networks towards upgrading to the indigenous sys tems subsequently. The Armed Forces can use the existing legacy systems without any time delay, through merging of modern Communication technological links; IP based networks, web based VOIP networks and Microwave carriers. Situational awareness needed and expected would be achieved to the desired levels.

3 CONCEPT TO DESIGN

3.1 COMMUNICATION ON THE GO:

The operational planning should not base its success on any presumably ever-existing fixed infrastructure. A committed communication platform based on any fixed infrastructure can't be guaranteed in the enemy areas. As the military leader always is prepared to extend the situational awareness to the last soldier in the battle, in near real time, he needs to carry forward the communication, the way the survey is taken forward in the forward areas. In fact, the communication plans are necessary to be executed prior to the commencement of the offensive operations. The cellular communication through commercial phones has reached the soldier to the remotest location, without any additional load or efforts. Similar kind of communication framework is essential for the Armed Forces today.

3.2 OWNERSHIP OF COMMUNICATION MEDIA WITH THE SOLDIER:

Though Communication is provided to the military leader using the signal resources, the ownership needs to be retained by the field commander. The end communication products, to be ultimately used by the soldier, should be so designed that they are easy to operate, without any major installation requirements, having limited power requirements and in a portable form. The communication framework must be on the "go".

3.3 "BUBBLE CONCEPT" – INNOVATIVE COMMUNICATION FRAMEWORK:

The concept of the Communications on the go in operations can be implemented without any major changes to existing framework, infrastructure or policies. The installation of such Communication framework is feasible, using "Bubble Concept". What is the Bubble Concept? Let us understand the concept of making a Communication
Bubble during operations in progress. The Bubble can be defined as:
"The network of Communication stations formed in the field through IP based protocols, based on distance and line of sight to the central terminal, is called as a Bubble".
Each Radio Set/ Mobile hand set/ Communication device that is handled by soldier will have an IP address associated, which can act as its unique identification number as well. This form of protocol called IP based protocols, will best suit the offensive scenario, as no elaborate frequency setting, installation or detailed setting up would be required. The soldier will feel at ease to operate the system totally insulated from the technology complexities that are instrumental in making the system simple.
The Communication stations deployed on field in connection to a centrally placed terminal become a cloud of connected stations in a network based on IP protocols. Such a network of ground/ field stations as a cloud is
termed as a Bubble. A number of products are available in the market today to fulfill such a requirement of establishing a bubble.
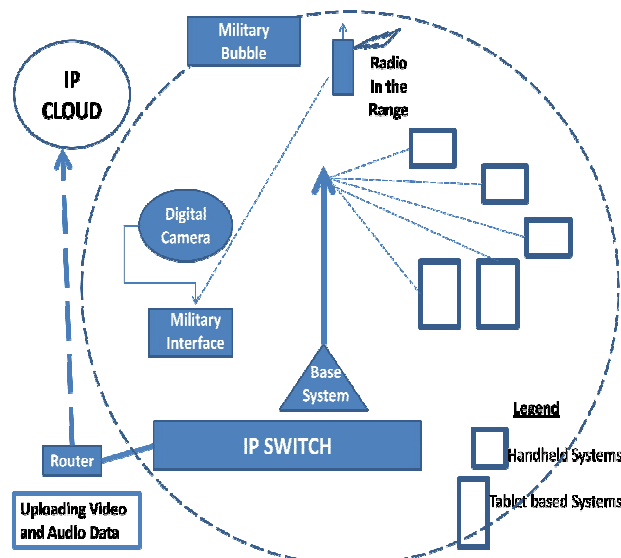

Figure 1 - Military Operational Cell Bubble

A Voice-Data communication system (VDCS) that can serve as multi frequency exchange for creating a central operational picture involving a multitudinal operators from different platforms on different frequencies. Such a system should be able to facilitate exchange of voice, video and data on a secure overlay. As the Figure 1 shows, VDCS Interface will be connected to an external (3G and 4G LTE) Micro Base Control Stations (BCS) using the IP or Ethernet interfaces to create a ***Military Operational Cell Bubble***. The BCS will operate at the layers one to three namely physical, database and network layers. With BCS becoming a base for the cells, it behaves like a single cell network.
The communication information (video, voice and data) flow from the field devices will be handled by the BCS and handed over to VDCS Interface as IP streams. VDCS Interface Video Streaming Server (VSS) card will have an IP address and will handle all video streams in the
VDCS Interface.
3.4 ANDROID BASED SYSTEM– Armed Forces are no exception to the surge of Android platform. Even a soldier with no formal technical training, operates the Android devices with ease. Being portable and light,Android operating system (OS) can meet most of the military requirements as well. So the need of the hour is to have equipment in rugged, light, mobile and easily operable, installed with Android OS, with each field soldier. Android App (Application) that delivers comprehensive video communications between a smart phone and operators / commanders at the field command center / other field command centers / upstream command centers through the VDCS Interface driven interoperability architecture, is the necessity. There are companies in the market today, which use the Smart Phone's microphone, speaker, video camera and still camera to test the productivity of the Android based systems. It should be feasible to extend inclusion of VOIP voice and text sessions also seamlessly in to the system. Without losing time on research, Armed Forces will be able to equip themselves with these communication equipment.

3.5 ANDROID APP. There is a need to have an Android App that could be installed on the Android system, so that all the envisaged Communication tasks could be undertaken with ease. The requirements for such an App are:
✓ App should support encryption and decryption of data.
✓ The storage of encryption keys should be done on device's internal memory itself, to avoid security related problems.
✓ The application should be able to be run on phone/ tablet/ any digital device.
✓ The application must be certifiable for full FIPS 140-2 compliance.

✓ Use of commercially licensed IP components should be avoided from security angle.
✓ There should be little or no license payment associated with any of the software component.

3.6 SECURITY ESSENTIALS. The following security aspects should be integrated with the system:-

  a. Confidentiality
   i. **Eavesdropping**:An authorizeduser should not be able to view actual data exchanged between 2 application users.
  b. Integrity
   i. *Client's identity* cannot be spoofed without knowledge of their authentication information.
   ii. *The application identity* should not be spoofed by any authorized/unauthorized client.
   iii. *Man-in-the middle attacks*: This form of attack should be prevented.
  c. A custom application for managing credentials needs to be developed. The application so developed should have the following characteristics:-
   i. Provide a user-friendly interface to manage security credentials (keys and certificates).
   ii. Provide a user-friendly interface to understand the current set of peers, with which, secure network communication would be undertaken.

4 PLAUSIBLE IMPROVEMENTS TO COMMUNICATION ARCHITECTURE:

The Communication Architecture of the Armed Forces today can be plausibly improved to suit the operational requirements without any major financial implications using the Android based system which will improve the operational efficiency.

4.1 APPROACH TO PROVIDE OFFENSIVE COMMUNICATION TO ARMED FORCES:

The offensive Communication plan for a successful Armed Forces operation must be able to be made as per the operational plan. The gap between the operational plan and the pre-conceived Communication architecture must be bridged. The Android based system will ensure Android phones and tablets in rugged form are held by each appointment in the battle. This sort of system will be efficient and the Communication on the go in the offensive scenario would be available.

4.2ESTABLISHMENT OF COMMUNICATION PLANS: A well drawn out Communication plan meeting the operational requirements must be presented to the military commander prior to launch of operations. The resource planning to meet such Communication plan must also be prepared and presented. The number of devices fielded with inter-se distances can be drawn clearly to establish a well designed field communication plan in the board room itself by the Commander for its implementation on the operational area.

4.3 PLANNING OF COMPLEMENTARY FRAMEWORK TO TACTICAL COMMUNICATION SYSTEMS OF ARMED FORCES OF ENTIRE WORLD.

 The tactical communication systems of entire world is the future of Armed Forces. While the process of implementation of tactical communication systems is likely to take greater financial implications for smaller countries with limited funds, a complementary mobile framework is necessary to be planned without any major financial implications. The Android based Communication system is the best form of complementary Communication platform that can be implemented in the interim.

4.4   CHANGE FROM FIXED FORM OF COMMUNICATION NETWORK SYSTEM TO MOBILE COMMUNICATION NETWORK SYSTEM: The Communication framework is generally implemented to suit the defensive operations. Planning operations in own territory will pose no major hurdles, though the same kind of efficiency in communication may not be easy in the trans-frontier operations with the current Architecture. Hence it is quintessential to plan and execute a mobile Communication Network, which is easily transportable, quickly installable, effortlessly operable, fully secure, cost effective, easily absorbed in to the current system and very flexible system. The Android based system meets these requirements quite evidently.

5 PROPOSAL OF A PROJECT TEAM – The teams belonging to Armed Forces, Government undertakings and the industry must get together to equip Armed Forces with the concept of bubble through providing the equipment as discussed. The military operational cell bubble must be incorporated for operational effectiveness of the Armed Forces through cooperative collaboration between the Armed Forces and the industry. The ideal representatives to take on such a project could be through experts with impetus on public- private partnership.

6 OPERATIONAL PREPAREDNESS THROUGH ROBUST COMMUNICATION FRAMEWORK:

 It needs no emphasis that the operational preparedness of Armed Forces is dependent on well-articulated resource planning and resource allocation. Armed Forces Command structure is reasonably geared up with latest equipment, ammunition with well prepared plans. However there is a clear and felt need for the Communication network Architecture to further mobilize to meet the necessary operational necessities. Hence the operational advantages that would be accrued through buildup of robust Communication Framework using Android based System with minimal financial implication will have to be evaluated and implemented on priority.

7 FORCE MULTIPLYING EFFECT:

7.1INSTALLATION OF COMMUNICATION BY MOBILE STATIONS – BUBBLE CONCEPT: As described above, the Communication Stations as part of a well chalked out Communication plan will always be part of a moving Bubble.

The distance between the centrally established terminal and the mobile Communications stations will be configured in the Communication plan as part of the protocols. The distance also will depend on the line of sight available. The Central terminal will be established by a nominated control station, which need not be a signal station. The Bubble concept can be implemented by a soldier, wherever, whenever he needs to be in communication with his control station. He will always be part of one or more Bubbles.

7.2 SECURITY AND INDEPENDENCE OF LAUNCH OF OPERATIONAL COMMUNICATIONS:
The security of the Bubble can be ensured using indigenous crypto equipment installed along with the Android based system as described. The form factor and the weight of the Communication equipment being carried by any soldier can be maintained to be as big as a tablet/ phone, to seamlessly integrate in the battlefield.

8 SECURE COMMUNICATION OVERLAY AND ADDRESSING OF TECHNOLOGY CHALLENGES.
8.1 GEOSPATIAL PLANNING:
 The Geospatial technology existing in the Operational Information Systems can be leveraged to find out suitable location for a central terminal and accordingly the mobile Communication Stations can be planned to be deployed on ground. The entire planning of establishing a Bubble to suit the operational plan will be in the hands of the operational commander himself, resulting in flexibility to alter his plans to surprise enemy through quick decision making. The plans are passed on to all the relevant stations and leaders instantaneously using the Bubble.

8.2 EASE OF TRAINING:
The training of soldiers and the operational staff is very easy, as no major technological executions are necessary to implement Bubble Concept. It is as simple as taking Survey forward using GPS handheld devices. The Operational Information Systems will gain manifold through the concept of Bubble. The existing operators in the fighting arms will be proficient to execute Bubble with very little training. The dependence on sophisticated training is ruled out.

8.3 FINANCIAL IMPLICATIONS:
 The equipment being carried by soldiers will be akin to a tablet, which can be android based. Such small form factor equipment will not only be light and easily operable by an ordinary soldier, but also will be very economical. The central terminal could be a suitcase based system, which can easily be transportable by any light vehicle. The financial implications hence will be very meager.

9 **TRIALS OF EQUIPMENT** – The trials of equipment on No Cost No Commitment basis are the best means of testing the concept of military operational cell bubble. The combined team of Armed Forces and Industry should be formed to fructify the project to reap rich dividends for the Armed Forces through establishment of a robust Communication Architecture.

10 PLAN OF ACTION –The signal Communication experts within the Armed Forces having full knowledge of tactical communication systems could be incorporated into the team testing the concept, besides including domain experts to take the project forward.

11 PROTOTYPE DEVELOPMENT - The prototype that needs to be created will have to provide the most secure communication tool to the Armed Forces, which should be able to operationally enhance the capabilities. This prototype since is cost effective and in-line with the plans of Armed Forces towards migrating to integrated tactical communication systems, with continuing policy of using static networks. A pictorial representation of showing a framework of radio, satellite, telephone on both GSM & CDMA, private telephone network

seamlessly integrated through the Android based equipment/ interface can be seen in the figure 2 below.
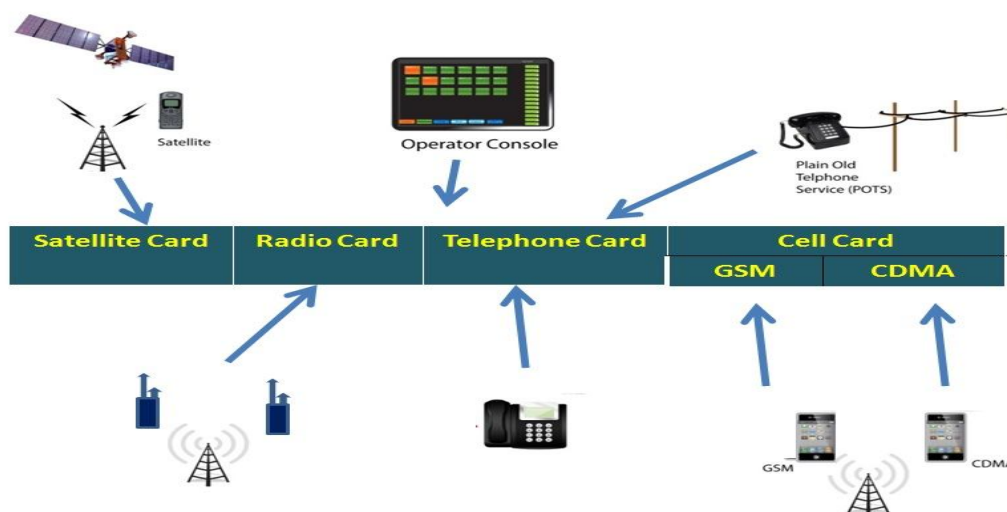

Figure 2 Video Data Control System (VDCS)

12 DEMONSTRATION OF THE TECHNOLOGY – The technology demonstration is a must in the form of a prototype in the Armed Forces. Unlike in the civilian agencies, the equipment must be tested in the field prior to launching officially for operational use. This methodology will be a force multiplier and will assist the Armed Forces in understanding the technology better. The operational effectiveness will grow not just with technology upgradation, but with detailed training to all the soldiers. Hence the prototype approach with field trials is mandatory. The demonstration of the technology through prototype should be put into operation with the entire cycle of design, development and demonstration to less than 6 months period.

13 TRIALS – The trials of the equipment should be part of the demonstration of technology. The trials should not just include experts from industry and Armed Forces, it should involve those who will operate finally. The inclusion of end-user in the form of soldiers will enable the developers to estimate the user-friendliness of the technology. There will also be direct interaction between the technocrats/ industry experts and the Armed Forces personnel, which will speed up the process of producing right kind of product.

14 FUTURE STRATEGY FOR CONTINUED ROBUSTNESS IN COMMAND AND CONTROL ARCHITECTURE IN THE ARMED FORCES.

14.1 ESTABLISHMENT OF R & D WITHIN THE ARMED FORCES:
The Armed Forces should look for Research and Development activities to build such equipment using its own resources. Hence a well orchestrated plan to have R & D labs at Armed Forces to build critical technology will help the Armed Forces too. The industry should be partnered by indigenous Government agencies for developing viable design concepts in the long run.

14.2 SECURITY LAYERS WITH THE CUSTODIAN:
The Communication Architecture design should be laid in consultation with the Armed Forces signals establishments to avoid last minute design change demands. The security system existing should get augmented with the security layers being built and developed with global compatibilities using superior technology or through upgraded indigenously built technology.

14.3 INCORPORATION OF TRAINING ESTABLISHMENTS FROM THE DESIGN STAGE:
Armed Forces own very professional training institutes, which impart training to highly motivated Armed Forces personnel, with very sophisticated equipment being deployed. If the design activities of critical equipment are made through collaborating with such training establishments, the ultimate cost of training and trials could be brought down. The R & D activities also can pick up pace in a pragmatic time frame.

15 CONCLUSION :

The Communication architecture in the Armed Forces is through a combination of Static and dynamic networks. Modern technology can enable optimization of these networks to help the Commander and Armed Forces Headquarters to have 24x7 situational awareness and hence make sound decisions in real time. A robust, secure Android system, if implemented it would be an efficiency enhancing system with operational logistics outreach and timely provision of seamless connectivity between various echelons in peace and field. This would consequently establish operational and Administrative Command, Control, communication and coordination compatibility in the Armed Forces as a matter of "Working" habit, maintains a very robust Command Structure with befitting Communication framework.

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