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TELECOM BUSINESS REVIEW

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Editorial Message

It gives me immense pleasure in presenting to you the seventh issue of Telecom Business Review (TBR 2014). The TBR has been a platform for scholars, teachers, professionals and students to contribute and showcase their knowledge, research, experience, study results and findings in the relevant areas of Technology, Business and Management. In the TBR 2013 Issue, we published articles on diverse topics such as Outsourcing, Customer Shopping Experience, IFRS, M2M, Revenue Assurance, Indian Vas Industry, Reactive data, Business transformation.

I am sure this year's issue of the TBR will also help to trigger quality studies in the field of Telecom Business Management and enlighten and educate the Telecom fraternity.

At the release of the seventh issue, I thank all the contributors for their thought provoking articles. I also express my heartfelt gratitude to the members of the Editorial Board and all our esteemed reviewers. I also seek the support of the telecom fraternity in our efforts of making the TBR global by contributing research papers that highlight global issues in telecom business.

Sunil Patil.
Director SITM

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Data Quality and Integrity Management for Telecom Operators

Asheesh Dongre

Global Practice Head- DQM, Tech Mahindra Ltd., Pune, Maharashtra.
Email: asheesh.dongre@techmahindra.com

ABSTRACT

Telecom operators across the globe face the challenge of improving and maintaining data quality to reduce revenue leakage and process failures. On the basis of the latest predictions on gross spend from the Telecommunications Industry Association, which is set to amount to a staggering USD 215,000,000,000 of lost business in 2014 alone. In any business, a 215 billion loss is scandalous – especially if it's essentially down to the administration of back office databases.

In current circumstances, where Average Revenue Per User (ARPU), is one of the most important Key Performance Indicator (KPI) for any Telco, it becomes vital to curb revenue losses while retaining customer.

Telecom industry as such, struggles to maintain its data quality due to sheer complexity of the systems and functions involved and volume of data to be managed. The problem gets accentuated with stiff competition, frequent induction of offers by service providers, regulatory institutions in different countries for telecom industry, advancement of technology (such as number portability, IPTV, 3G services, etc.) In these days, where ARPU is monitored to the extent of one paisa/cent/pence, no telecom operator could afford to lose its share of money due to poor data quality.

Data quality and data integrity (DQ & DI) management market landscape is fast evolving. With the spurt of COTS and free ware, DQ & DI is getting most hit, forcing operators to look for solutions. There are plenty of DQ tools available in the market, but there isn't any framework available which can ensure 100% data integrity across the system landscape. Telecom operators expect from DQ & DI solution providers that they will 1) leverage the experience gained in this domain 2) bring automation 3) build reusable and easily deployable components and 4) Ensure reduced costs of DQ & DI engagements

Clearly, there is significant business potential in this space.

Keywords: Data Quality Management, Data Integrity, KPI, Revenue Leakage Prevention, Enhancing Profitability and Customer Satisfaction

1. INTRODUCTION

Last decade has witnessed exponential growth in telecom sector. In India alone, there are 791 Million mobile phone users**! Advancement of technology has triggered introduction of new services e.g. IPTV, 3G services, applications on mobile, etc. Telcos have evolved their IT estate over the years through series of internal changes, implementing Components off The Shelves (CoTS) and improving business processes. This resulted in a stack of applications, working in silos and thus corrupting data during its journey through them.

For any telecom operator, the holistic data quality scenario would be to witness the data travel from its origin application to destination without getting changed, unless intended for. The key is to devise a data management strategy which tracks data through the entire journey and minimizes human intervention.

The business challenges posed by data quality and integrity issues for Telcos can be summarized into three main areas. Minimizing revenue leakage, maintaining and delivering on their Service Level Agreements (SLA), and retaining their existing customers. To address these challenges, the Telco has to systematically approach the problem and find answers to many things including the following:

1. Understand what are the key drivers to approach data quality and integrity issues
2. Get a thorough understanding on reasons for data discrepancy and poor data quality
3. Identify which product and service lines have major issues with data quality

4. Which applications are having major data quality issues
5. What percentage of revenue is lost due to poor data quality
6. What are end customer expectations on fulfillment and assurance SLA
7. Which best practices in data quality management can be incorporated
8. How to execute a major data cleanse and transformation program

1.1. Reasons for Poor Data Quality

While tremendous expenditure is being made on data quality issues, most Telcos still struggle to address this. The primary reasons for this cost of failure can be summarized as below.

Silos and short time project focus: Most of the projects are funded at business unit level hence the impact of data across the organization is not analyzed. Data flow between systems and interface design poses severe constraints

System complexity: Organizations are maintaining more information and larger number of integrated systems than that in the past. With increasing customer demands and regulatory compliances, M&A and globalization are making data quality management challenges increasingly alarming

Traditional development methods and stove pipe applications: The end user's desire to build new functionality and add stove pipe applications results in an information mess.

Hidden data quality issues: Data quality issues can exist unnoticed for some time. This data flows to other systems as more interfaces are built thereby increasing the risk of data corruption.

Data quality is a mindset: A front user may not have the same interest and incentive to maintain the data quality as a business decision maker. Poor data can be curbed at its point of entry only if the user keeps a vigil.

In short, usually when data is integrated, summarized, standardized and used to arrive for a business decision, data quality issues begin to surface.

2. Impact of Poor Data Quality in Real World

Due to poor data quality, Operators lose revenue at every stage of the end-to-end process. The table below depicts the challenges faced by Operator at each stage of the journey.

End-to-End Process and Impact on Service Journeys

Marketing and Sales	*Service Delivery (Lead to Cash/ L2C)*	*Fault Management (Trouble to Resolve/ T2R)*	*Billing and Revenue Assurance*	*Information Management and Reporting*
• Cannot contact relevant customers • No information for analysis, e.g. Customer Segmentation • No or incorrect information on customer behavior and what products the customers already have, to drive marketing and targeted sales activities	• Waste of efforts and time • Weak Customer Experience Management due to delays and errors • Employee frustration due to rework and under information	• Waste of time • Poor Customer experience due to delays and mistakes • Employee frustration • Downstream knock on effects on inventory , T2R,billing & reporting • SLA breach and penalty cases	• Lost $$ due to under charging • Fine $$ due to regulatory non compliance • Overcharging $$ by suppliers	• Waste of time in data cleansing • Inadequate reporting and impaired decisions • Derive wrong decisions due to incorrect data

*Some of the real life examples of data quality and integrity issues are listed below:

2.1. Example 1: Network Inventory data Misalignment Across Service Delivery, Assurance and Billing Systems

The misalignment of data between the network and inventory may lead to huge revenue losses. This may be due to inadequate use of the ports available in the network thus preventing reuse of the ports thus additional revenue being spent on new ports. Also, improper utilisation of available circuits and Penalty paid to the customer due to SLA breach, T2R issues and customer dissatisfaction may lead to revenue loss.

2.2. Example 2: Incorrect Supplier Invoicing Leading to Revenue Leakage

There may be instances where there are discrepancies between the Supplier charged value ($$) and customer billing ($$). In such cases, the supplier charges the operator for a circuit which is ceased/inactive at the customer site but the operator's system reflects it as inactive because of which the customer is not billed thus incurring unnecessary loss of revenue.

3. DQ & DI for Telecom

For a Telecom operator, DQ & DI function would include functions depicted in picture 1 below:

Inventory Cleanse – This can be categorised into Operational and Commercial Inventory.

3.1. Operational Inventory (Customer & Network)

This information is required by the operations teams to service and manage Operator's contractual commitments to the customer, site addresses network, CPE, etc.

Customer- Customer refers to the physical customer as in legal entity and appearance in the tracker, spread sheets. Customer data items include Customer name, Cus ID, Sites, Address, Location, etc .

Network - All network devices and circuits

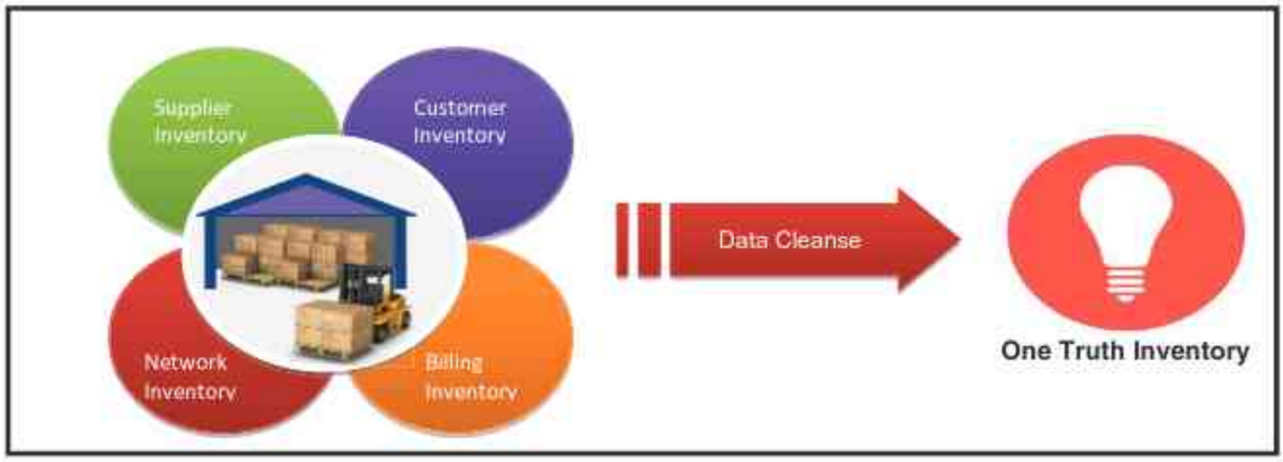
3.2. Commercial Inventory (Billing & Supplier)

Information required by the Operator's team to support the finances of the contract, billing, supplier invoices, cost analysis etc.

Invoicing- Supplier invoices to Operator typically. Identification of 'billable' material that establishes an audit trail from supplier to bill

Billing- Billing includes individual components and services (including resources) that form part of the commercial contract between Operator and its customer.

Picture 1

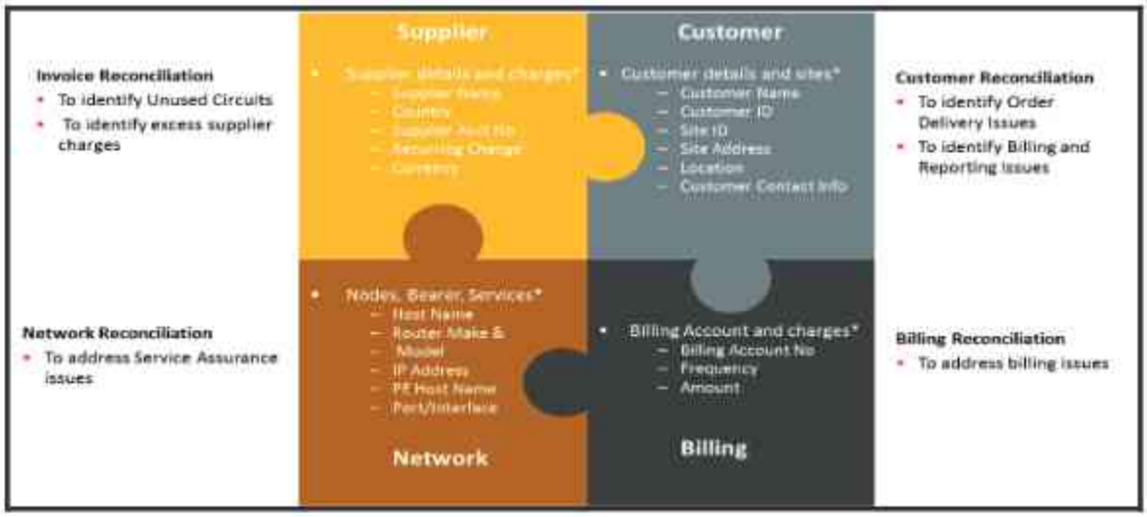


4. Sample Entities For DQ & DI in Telecom Domain

Telecom domain is very complex and has numerous entities representing various features and functions. The

major entities for DQ & DI are as highlighted in this picture 2:

Picture 2

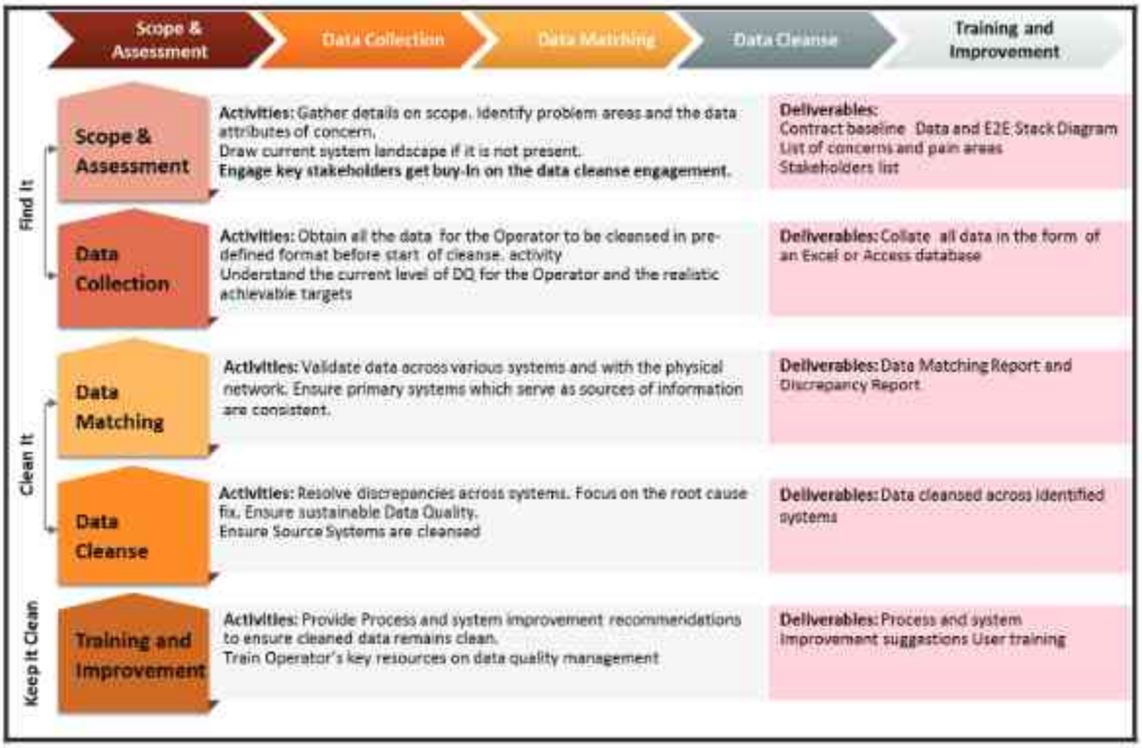


5. Data Quality Management and Data Cleanse Framework

Picture 3 illustrates the framework for data quality and cleanse:

Data Quality Management is more than just addressing historical data quality issues through data profiling and re-engineering. It involves preventing these issues from occurring in the first place.

Picture 3



The Data Quality Management and Data Cleanse Framework (DQMDC-F) propose a multi-pronged approach to review and monitor data quality regardless of the application complexity and identify recommendations for simplification/optimization of the same.

This framework comprises of broadly five phases –

(a) Scope and Assessment b) Data Collection c) Data Matching d) Data Cleanse e) Training & Improvement

a) Scope and Assessment

Input

The primary input here is the list of stakeholders, applications and business users from the Operator and other specific requirements in the form of industry acceptable format that need to be addressed. The requirements should clearly define the area of cleanse.

5.1. Procedural Steps

Step 1: Work with the Operator's team to identify the pain points and areas of cleanse. Confirm if the cleanse requirements provided to data cleanse team by the various stakeholders are valid and need to be included in cleanse scope.

Step 2: Engage with the designers and operations team to understand detailed requirement breakdown

Step 3: Establish the attributes and systems that need to be cleansed

Step 4: Prepare scope document and delivery plan based on discussions and send for sign-off

5.2. Output/Deliverables

1. Signed off scope document with clear definition of scope and out of scope
2. Delivery plan / execution methodology
3. Issues, risks and dependencies (internal & external)

b) Data Collection

Input

Scope document and execution plan for the contract

5.3. Procedural Steps

Step 1: Establish the One Truth Inventory. Obtain the data from the various systems identified in the scope of data cleanse

Step 2: Gather the data in a pre-defined format and upload into a common repository for analysis (if applicable)

Step 3: Establish the current data quality (DQ) baseline for the areas agreed in data cleanse scope

Step 4: Share the established DQ baseline figures with the Operator and obtain a sign-off on the initial analysis with the stakeholder

5.4. Output/Deliverables

Signed- off DQ baseline for the contract

c) Data Matching

Input

Scope document and execution plan for the contract; Data extracts and baseline DQ percentage

5.5. Procedural Steps

Step 1: Store data from various systems gathered as a part of the data collection phase into a repository

Step 2: Establish set of rules for data matching concurrence with Operator's business users

Step 3: Compare the data in as per business rules

Step 4: Present result of the analysis in form data discrepancy report

Step 5: Obtain sign-off on data discrepancy report

5.6. Output/Deliverables

1. Signed-off data discrepancy report
2. Business rules for data matching

d) Data Cleanse

Input

One Truth Inventory; Signed-Off data discrepancy report

5.7. Procedural Steps

Step 1: Work with the Operator's team to resolve the discrepancies. Require their agreement to resolve the anomalies

Step 2: Present the correct values for the anomalies to the Operator team for sign-off before updated to the systems. The data first needs to be ideally updated and validated in a testing environment before it can be ported to production environment

Step 3: Obtain sign-off on the updated data from the Operator team

Step 4: While cleansing the data, carry out Root Cause Analysis (RCA) for data discrepancy

Step 5: Post data cleanse, implement continuous data monitoring mechanism in place and make data quality a ritual!

5.8. Output/Deliverables

1. Signed-off Data matching report
2. Clean data ready for upload

e) Training and Improvements

Input:

Root cause analysis done for data discrepancy

5.9. Procedural Steps

Step 1: Identify the changes that need to be done to the BSS/OSS (Business/Operations Support Systems) in order to address data discrepancy issues resulting from system issues. These shall be shared with the Operator teams

Step 2: Identify the changes to the existing process and work instructions in order to address the data discrepancy issues. These shall be shared with the Operator teams

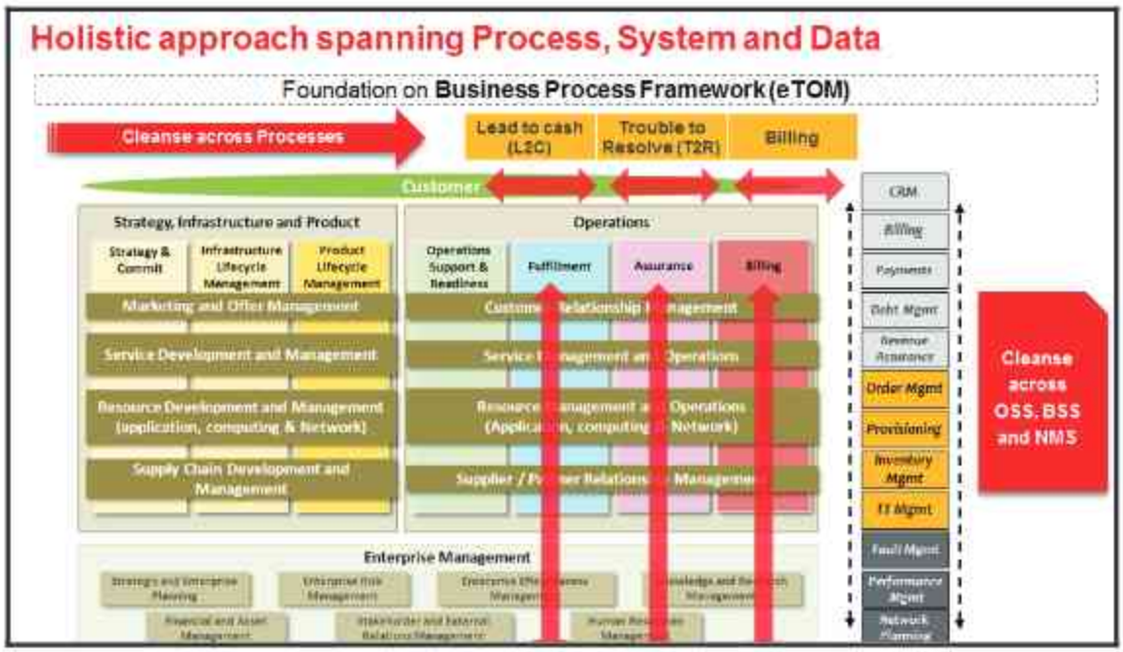
Step 3: Identify user training requirements and pass it to Operator teams

5.10. Output/Deliverables

1. RCA Register
2. Process improvement suggestions
3. User training suggestions

6. Holistic Methodology for Data Quality Management

Picture 4



An operator cannot overhaul all business systems to improve data quality. It has to adopt a systematic and consistent approach aligned with industry standard methodology. eTOM or enhanced Telecom Operations Manual (now Frameworx) is the set of guidelines which an operator can follow to enhance its data quality across processes, systems and service journeys.

For any operator, it is advisable to curb data quality errors at the inception itself. It should enforce rigorous checks to ensure that data quality is maintained at the source system. Enhancing data quality at master system ensures that half the battle is won! Thereafter, a robust data governance framework will ensure that the data integrity is kept intact.

7. DQ & DI Business Benefits

Data quality and data integrity results into many tangible and intangible benefits for the Telcos. These benefits mean substantial reduction in revenue leakage, customer churn and information loss. These benefits can categorized into Organizational, Financials and Enhanced Customer Satisfaction and are covered in greater detail below

Organization Benefits: The most significant benefit for the organization on undertaking the DQ and DI initiative will be the availability of a Single version of truth for data. The key data elements will be in alignment across systems and the MIS staff can spend their time analyzing the data and not 'verifying' it. The exercise will also help the operator adhere to local and global regulatory and compliance requirements while also enjoying improved operational efficiencies. An quantitative knowledge of quality issues will also become available paving way for long term solutions. The standardization of data format used across the functions/applications will also help bring standardization across business operations. Benefits such as freed up network and other resources can be used for planning and resource assessment would provide vital inputs to decision making on technology adaptations, migration and product rollouts within a perceptible outlook period.

Financial Benefits: The most obvious and immediate benefit of a DQ and DI exercise is the reduction in revenue leakage resulting in reduced Opex. Reduction is spend on rework due to poor data quality and well informed and correct decisions enabling organization to expand/ retain business/customers are some of the other benefits that will also result in superior financials.

Enhanced Customer Satisfaction: While Organizational and financial benefits will abound, the enhanced customer satisfaction to continue to deliver results far longer than the initial period. Unique customer records reflecting integrated view of customer across the organization paves way for improved customer retention and reduction in customer churn. Enhanced customer experience will naturally occur as their data is correct and update and there will be less errors in interaction, billing and other areas.

8. Automation and Innovation

Complexity of the process and system involved and the huge size of data makes data quality and integrity a big and complex activity. Organizations offering DQ & DI solutions cannot reinvent the wheel every time they work with new operator. Cycle Time (CT) reduction, improved Right First Time (RFT), cost minimization and effort reduction are key parameters for any data quality engagement. Data quality and integrity services have to industrialize the offering by

1. Creating a framework for repeatable solution
2. Automation by adding tools to the framework
3. Getting the data quality offerings on a single platform to standardize deliverables
4. Standardization of KPI reports for DQ & DI

There are many examples where repeatable solutions can be incorporated such as Address Cleanse, Customer ID Cleanse etc. However, these tools, in isolation won't prove of much benefit because though these could improve data quality but data integrity across the system landscape will not get enhanced significantly. Unless a holistic framework is created which covers DQ & DI, operators would continue to struggle with revenue leakage and consumer dissatisfaction.

8. Emerging Trends

Big data and social media are the latest transformation concepts that are shaping global technology. As per NASSCOM, the Big data market in India will grow at 83% annually to reach US$1 billion by 2015. Over the next decade, digital information in India will grow from 40,000 petabytes of data to 2.3 million petabytes, twice as fast as the worldwide rate. With 900 million+ mobile connections, 100 million+ active mobile data users and increasing number of connected devices, the amount of consumer and enterprise data will grow exponentially.

Data complexity will continue to increase in future and

less than 10% of organizations are currently equipped to manage these unstructured data sources effectively.

The diversity of data sources, its integrity across systems and its usage across business reporting, presents a technological challenge in capturing, storing and analysing information between seemingly unrelated, large and complex data sources. Considering the sheer size of data that an organization has to deal with, it becomes imperative to plan for a robust and scalable framework for data quality management that could manage data across its life journey.

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Implementing the New Age Telecom Business Model – An Operational Perspective

Niladri Shekhar Dutta

Customer Principal –OSS/BSS Consulting practice, Middle East Africa (RMEA), Ericsson AB, Dubai, UAE. Email: niladri.dutta@ericsson.com

ABSTRACT

With the changing Telecom economies and modalities of doing business the technology industry is vast changing. Telecom is not an exception of the same phenomenon. There are newer ways which the Telecom operational excellence stakeholders are thinking to minimize costs and thereby maximize investments. One such concept is adopting a comprehensive operational blueprint called the TOM or the Target Operating Model. The concept of the Target Operating Model is going to identify the best possible approach which a Telco needs on any on-going Transformation program and thereby present a pragmatic view, on their e2e IT Operations, to meet the Business Objectives. This also helps to paint the BIG picture in front of Telco management team as well as all associated stakeholders, by linking logically the intended deliverables of any major project engagement of a Telecom OSS/BSS transformation program. The Target Operating Model -TOM' is aimed to present a holistic view to the Telco management as a best possible Operational 'Blueprint' which they adopt to realize their business vision. It aims to map this 'Blueprint' as a pragmatic approach to the operational vision of the COO. It helps the Telco to better understand what should be done in an ideal state and how to operationally realize the entities of People, Process and Technology to yield tangible and intangible benefits through operational 'value' creation.

Keywords: Operating Model, Blueprint, Landscape, End to End Operations, Operational Dimensions

1. INTRODUCTION

Globally Telcos across the world are striving hard to decipher the "ideal" or "near perfect" service provider business model in todays' dynamic and ever changing globalized economy. Unfortunately there is no "right" answer or a guidebook that would ensure Telcos aim for the same. It of course depends on socio-economic, political and demographic characteristics of a particular state or a country. What works for one may not be suitable for the other. But surely and sincerely there should be a logical attempt to strive for the best combination or an aim to strive the perfect balance between what looks strategic as a market differentiator visa-viz that could be well operationalized in practice. There is no point in being presumptuous with strategies in an idealized world which cannot be implemented in real practice

Ideally when we look at any Business model with Telecom not being an industry exception we do look at 5 *key entities*, which help derive, a logical model that could link the source of revenue generation to the destination of revenue realization. These logical entities, if we may so term them could be broadly classified into the following dimensions or paradigms viz. *'product or service' offering, 'Infrastructure or assets' delivering these services, 'substitutes' or near target offerings, 'competitors' and finally the 'end customers'* who would be consuming the services. Referring to the 'Business Model Canvas' by Alexander Osterwalder, it states that "The Business Model Canvas is a strategic management and lean startup template for developing new or documenting existing business models. It is a visual chart with elements describing a firm's value proposition, infrastructure, customers, and finances. It assists firms in aligning their activities by illustrating potential trade-offs. The Business Model Canvas was initially proposed by Alexander Osterwalder based on his earlier work on Business Model Ontology. Since the release of Osterwalder's work in 2008, new canvases for specific niches have appeared, such as the Lean Canvas."

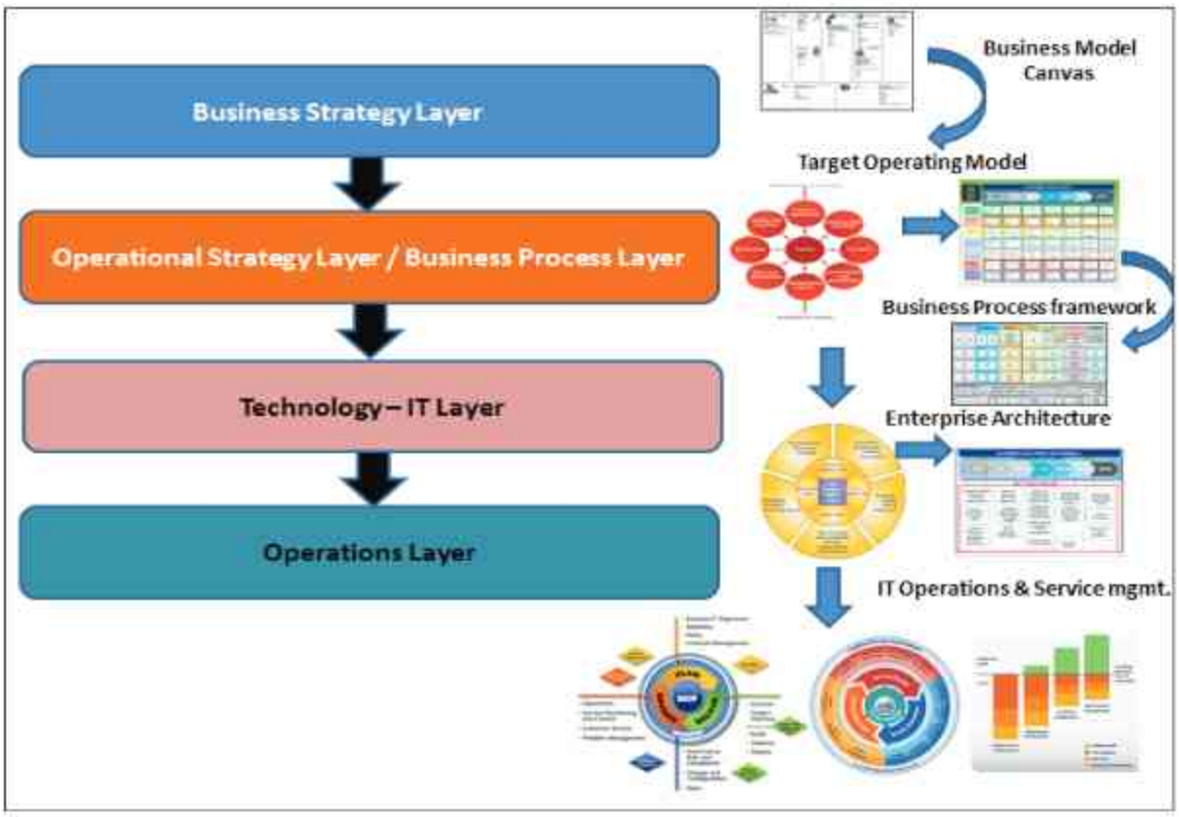
Taking this model further, it can be stated that the Business model canvas can be drawn with some of the *key dimensions mentioned above* that could help link these and form an integrated logical blueprint. Strategically this needs to be revised or reviewed every year preferably by the CxOs to ensure that the model is living up to the standards and is catering to much needed challenges of the ever changing Telco market and the economics. Thesekey dimensions are very specific to the business and the industry which one operates and in a Telco context these would include *key partners, key activities, key resources, the value proposition, channels, customer relationships, customer segments, the key cost structure and finally the revenue streams*.

2. OBJECTIVES

The key question that needs to be addressed while deciphering the business model for any Telco would be to strike a balance between service provider prioritiesand service enabler priorities. The real key issue is to engage with customers and provide a differentiated service at a personalized level. One can vividly imagine the complexity that a Telco often faces whilst realizing their business model.

In a fast changing data and VAS intensive service portfolio, leading to its increasingly more complex realization, this therefore leads to a strategy where in one needs to closely integrate a business model and a target-operating model. Implementing any business model or business idea would require operationalization of these key ideas and linking them to various facets that exists within the operational dimensions. The key to this realization is the operationalization of the same through a competitive and comprehensive approach or a blueprint, much stated as the target operating model. The concept of the operating model is such that it is a distinct derivative of the business model and the single most entity that forms the link between the business model and the business process layer of a Telco. Not many Telcos can do a predictive forecasting about the success of operationalization of their business model because while strategizing all they usually visualize is how to provide a differentiated service delivery experience to the end customer without too much focus or analysis on the operating model. The key to a successful strategy for any service provider business would be the link between the business model, the operating model, the business process and the key performance indicators or KPIs, which should cut across various layers of the enterprise.

Figure 1 Different Layers Within the Telecom Business and Operations Layer



3. METHODOLOGY

The first objective of this paper would be to define what is meant by TOM – Target Operating model, its perspective and usage in the global Telecom world and how is it different from the established frameworks like eTOM, TAM and SID.

By definition the TOM or Target Operating Model is an *operational blueprint* which would enable CxOs of any telecom service provider to understand the "operational" capabilities they need to define within their set up in order to cater to their immediate business needs. It gives a unique perspective to multiple stakeholders from business, IT, Networks, Finance, HR and other department functions thus helps to paint a holistic picture of the much needed "capabilities" across various organization dimensions.

A diagrammatic illustration of the overall BIG picture from an e2e Telecom operators' business model and operating model perspective is shown below for ease of understanding. This is just an illustration and interpretations and variations may occur as per readers' discretion. However, the moot approach remains the same.

The (Target) Operating Model is aimed to bridge the gap between the Business Strategy layer and the operations layer of a Telco. While looking at a Telco enterprise management layer it's the single most important connect between the Business model and the Business process stack or BPEL / library. An Operating model view can be both 'Strategic' as well as 'Tactical'. It helps to maintain an optimum balance between these 2 perspectives and gives a most acceptable framework, which aims very easy decision making for Telco stakeholders in terms of maturity or state of operations as well as to drive operational investments.

The Operating Model in A Telco Enterprise management and strategy set up is going to identify the best possible approach which a Telecom service provider needs to adapt while rendering their services once they have attained a certain state of finalization and maturity of their Business model. This also helps to paint the BIG picture and transforms it into a more pragmatic view much acceptable by internal and external stakeholders. It helps Telcos to better understand what should be done in an ideal state and how to operationally realize the entities of People, Process and Technology to yield tangible and intangible benefits through 'value' creation.

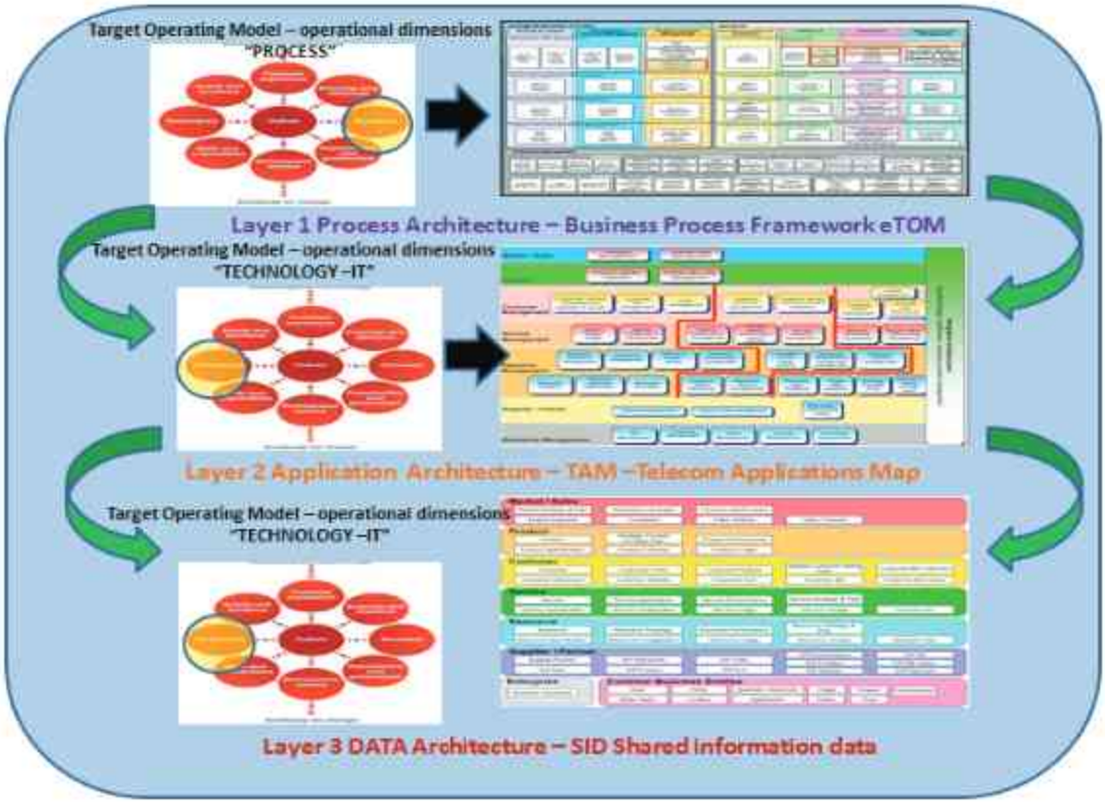
Telcos are increasingly succumbing to the concept of defining a Target Operating model design exercise while they have defined and modeled out an unique business model. The Operating model is based on looking at several key entities starting with the key operational driver for the Telcom operator, which could be any business transformation drivers like customer centricity, operational excellence or revenue maximization.

The Target Operating model guides the development and delivery of each capability required for the Enterprise Business's value propositions. Identifying the Target Operating Model dimensions listed below. There are 8 or 9 major dimensions of the Target Operating model which have been identified for the enterprise architecture framework or the enterprise strategy layer and these are well accepted for any particular kind of Telco ranging from fixed line, mobile broadband or quad play operator. These dimensions remain common across any of these service providers, the degree or the extent of operational readiness changes depending on the type and kind. For eg. Any MVNO would have similar maturity in terms of process, KPIs or organization as compared to a quad play operator who would have more matured processes, KPIs or organization.

The overall TOM approach can be distinctly broken down in 2 phases viz. Designing the TOM and Operationalization of the TOM.

Designing the TOM or the Target Operating Model starts with the identification of 'key' business objectives identified by a Telecom management team from a BSS or OSS perspective while designing a transformation program. These objectives need to be mapped to the 'high level' generic capabilities that a Telco set up can bring in. The output of this capability design exercise and its key findings would act as an input or trigger to the Operating Model definition rationale. From the High level 'generic' capabilities we need to identify specific capabilities mapped further into the identified process domains viz. (Concept to Market) C2M essentially the product life cycle of a Telco, L2C (Lead to Cash) essentially the IT order to cash solution functional chain of the Telco and T2R (trouble to resolve) essentially the IT support operations domain, which is our base line from any business and operational process work. However these specific telecom functional and operational capabilities would further need to be broken into drill down specific solution area capabilities covering Product or service offering, PoS (Point of Sale/ customer touch points), Partners, CRM (Customer relationship management),

Figure 2. The Inter-Relationships of TMF Frameworx and TOM



Billing (includes Rating/Charging and Billing) and lastly Finance and Payments.

The next step would be to identify the key themes for the Target Operating model, which would ideally have a direct correlation to this high level process 'domains'. For easy base lining and linkages to other entities like the business process framework, KPI metrics or performance metrics, which would also include both high and low level KPIs along with SLAs. We must group these to the above proposed Process Life domains viz, C2M, L2C and T2R or more holistically either into O2C or P2P (product specific) process life cycle domains. This also helps to rationalize the business processes during live operational run. We would then drill down the specific capabilities mapped to the process domains into each solution specific areas within the scope of the transformational program. An example of such an operational blueprint mapping could be witnessed in a typical BSS transformation catering to the following areas within the Telco for eg. Product/Service offering, Point of Sales, Partners, CRM, Resource Management, Billing and Finance functions. The rationale is to independently contribute to the overall Operating model encompassing these solution areas.

The second phase starts with the Operationalization of the TOM. As part of the exercise, there are 8 'dimensions' or 'imperatives' which would help us harmonize each solution domain with one another. The 8 dimensions would be based on the following – '*Customer Experience*', *'Sourcing and Alliances'*, *'Technology- networks'*, *Technology IT' (essentially the OSS/BSS landscape)*, *'Key Processes'*, *'Metrics and KPIs'*, *'Assets'*, *'Enablers' and 'Skills and capabilities'*. These independent areas would have stand-alone sub operating models by themselves, which would of course contribute to the overall Target Operating Model. Each of the Process and the solution domains within the Target Operating Model would also be closely aligned with the end-to-end Telecom KPI (key performance indicators) metrics, which would closely link the business KPIs along with the business process KPIs, and the operational KPIs in a typical hierarchy fashion.

One must also understand that the TOM and the established business process framework like eTOM are entirely different and they must not be used interchangeably or should be overlapped with one another. Instead both of these co-exist at different levels with different functional and operational needs for a Telco stakeholder.

TOM is aimed for CxOs whilst planning their operational strategy which is mainly aimed at showcasing an ideal operational blueprint model. Hence it helps to identify operational "capabilities" that a Telecom service provider needs to build up to sustain and meet business challenges. It cuts across all operational dimensions like Customer experience or customer centricity, KPIs, business processes, people, skills and capabilities, sourcing strategies or partners, technology which includes networks as well as their IT (OSS/BSS) landscape.

The overall e2e (end to end) correlation between the best practice frameworx like eTOM, TAM and SID along with the Target Operating Model –TOM is highlighted below in the following diagram.

The key difference between eTOM and TOM lies in their usage and perspectives by which they are being viewed. eTOM which is essentially a framework, on the other hand is focused mainly on the business process layer and is predominantly used as a business excellence function where in it details out the process landscape and what all business processes an operator needs to have and follow as a best practice. It does not cater to any other dimension of people, skills, or technology. TOM needs to be defined at the first step of operational strategy, process capabilities needs to be identified and the one must look into complying to a best practice framework like eTOM thereafter.

3.1. Findings/Discussion

The diagram below reflects the guiding principles and definitions of the Target Operating Model (TOM). These would enable the stakeholders to align the listed drill down capabilities from the High-level capabilities mapped to each of these Operational dimensions. The rectangular boxes are a reflection of the operational dimension needed to complete an operating model.

The findings of the operating model would be closely a summation of the operational components of each of the sub-operating models derived from each functional domain mentioned above like PoS (point of sale), CRM, Billing, Resource management etc. The key findings would be these operational components which would help materialize the business findings or the business imperatives which have been thought of while defining the business model. These operational components will lead to the business process layer and thereby mapped to the key solution use cases through the business processes.

There are a few global examples across geographies mentioned below wherein Telcos have adopted the

Figure 3. Understanding the Operational Dimensions of TOM

concept of TOM and the way they are described. The notable point here is in each of examples TOM is being implemented in different context across various functions, scope, departments which is across the length and breadth of the organization.

A Telecom major incumbent force in the UK while redesigning their contact center operations implemented TOM across their CRM and contact center functions to address the maturity and capabilities which were much needed to changing market needs and demands thus delivering extremely highly satisfied SLAs to their end customers. This has been very successful while looking at their newly designed contact center operations and it also helped to focus on key business and operational focusses which were defined within the process dimension of the Target operating model for their contact center. Also it helped them to minimize and streamline their opex (operational expenditure) in a significant way and improve on overall profits. In this scenario though both "Design" and "Operationalization"of the TOM were in focus, however the focus was much more in the second part primarily being driven by the contact center operations which was essentially 'service' assurance and SLA driven more than anything else. Hence lots of emphasis was given to the implementation of the TOM especially to ensure enhanced customer experience could have been achieved and the service provider could remain competitive in the market with regards to competition.

A Telecom major force in Africa primarily operating in the mobile space have designed and defined a TOM for one of their key network functions which acted as a strategic interface between business and technology networks. They had looked at TOM as a best practice blueprint to transform their organizational capabilities which would have been much needed to shift the CxOs focus to operational drivers which haven't been thought before. Thus TOM became a key essential entity to be looked at while transforming the networks organization as a whole. In the context of the project scope being delivered the "Design" of the TOM was only being considered as the CTO was keen to look at the functional network business services blueprint at this stage.

A telecom major in the Middle East opted for defining and designing their TOM across their IT landscape and various IT functions while undergoing a complete end to end transformation program, where they were integrating 6 different applications within BSS. This was a major transformation as the complete IT end to end architecture was getting changed. The TOM was intended for business excellence and CIO/COO's office wherein they can look at it as a checkpoint for specific capabilities being delivered as a result of the transformation program through chosen solutions. Being a major transformation program in the BSS space the telecom major decided to go with both the "Design" as well as "Operationalization" of the TOM respectively. These were carried out in the two distinct phases of the program viz. the Analysis and design phase of course saw the introduction and design of the blueprint of the operating model , accompanied by the process and solution and implementation phase which saw the "operationalization: of the TOM.

3.2. Inference or Conclusion

The output of the Operating Model should be able to give a good enough perspective to the Telco management team on how to better manage the operations and align their strategic viewpoint to this model. Any business blueprint which would be visualized by the core business strategy team and the business stakeholders of the Telco could well be put into operational mode by the target operating model design and the method described in deriving the TOM. The output will also closely link with the KPI Metrics, which needs to be built up either internally by each team or group head or functional heads of various teams. However this is not the complete end result, which ideally a Telco management would look for, both in terms of tangible benefits of revenue or costs and intangible benefits in terms of operational efficiency. In order to achieve this, one needs to logically derive the quantitative and qualitative yields of the Operating model. Mapping the Operating Model to the end-to-end KPI Matrix designed and then align it to the Balanced Score Card of a Telco management team and thereby control and decide on the benefits would do this ideally.

On attaining maturity of the above suggested approach, the final goal would be to link this (control point matrix related to Revenue and Cost) back to the Products and Services offerings of the Telco which would in turn help the management to realize the impacts of the success and failure of any services being offered from an operational perspective. Thus its evident that while implementing any business for any Telco one should not be thinking in isolation but instead would be taking in due consideration the necessary operating model which needs to be closely integrated to implemented these differential business ideas.

Abbreviations/ Glossary	***Meaning***
C2M	Concept to Market
L2C	Lead to Cash
O2C	Order to Cash
T2R	Trouble to resolve
P2P	Promise to pay
eTOM	Enhanced Telecom Operations Map
TAM	Telecom Applications Map
SID	Shared Information Data
TOM	Target Operating Model
TMF	Tele-management forum
KPI	Key performance indicator
SLA	Service level agreement
CRM	Customer relationship management
PoS	Point of Sales
BPEL	Business Process Execution Language
BSS	Business Support Systems
COO	Chief Operational Officer
CTO	Chief technical Officer
CIO	Chief information Officer
RoI	Return on investment
Opex	Operational expenditure

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Monetizing SDN: Emerging Business Models

Anuradha C B, Parag Pathak, Samir Ranjan

Lead Consultant, CSI ADM & PMO, Ericsson India Global Services Pvt. Ltd., Pune, Maharashtra, India.
E-mail: anuradha.c.b@ericsson.com, parag.pathak@ericsson.com, samir.ranjan@ericsson.com

ABSTRACT

The networks have become critical component of infrastructure in society, and have evolved over decades, bringing in the complexities with them. However, the new requirements for the networks, such as data center networking, cloud computing, L4+ network services, and so on are finding the traditional networking approaches as huge barriers. The networks are bound to witness disruptive changes in overcoming these barriers.

At this juncture, SDN is emerging and is seen as a way to open up the closed network for innovation. SDN has now become reality and the speculation has ended, with many leading organizations strategizing around SDN.

The current vertically integrated closed telecom networks have opened up with SDN, transforming their business models and bringing in the new customers. The time is ripe, hence, for formulating the new business opportunities. The objective of this paper is to explore the ways to monetize SDN and formulate business models, through the findings by adopting Secondary Research methodology, by exploring SDN business ecosystem, driving factors and value chain. It also discusses the suitable business models that organizations could take forward, by discussing the applicability of business models in other domains to network domain, and formulating business models with Open source.

Keywords: SDN, NFV, Business Models, Open Source, Value Chain, Business Drivers

1. INTRODUCTION

Network growth is a looming nightmare for network administrators. Server virtualization, advanced data center management, cloud computing and smart mobile devices have become game-changers for both service providers and consumers. On one hand, these advancements enable service providers to deliver quick and cost-effective new services and on the other hand they enable consumers to work, play and collaborate anywhere at any time, using any device.

SDN has emerged predominantly aiding us in overcoming the difficult situation. It has also come to the reality, ending the speculation and the hype associated with it. This has opened a plethora of business opportunities for System Vendors, Network Enterprises and Startups.

2. OBJECTIVE

The objective of this paper is to explore the ways to monetize SDN and formulate business models, through the findings by adopting Secondary Research methodology. Here, we observe the driving factors for the SDN ecosystem, the evolving value chain, the network transformation, while discovering the monetization opportunities, with an objective to explore Business Models for SDN. We further discuss the various business models that the system vendors, established enterprises and start ups could strategize with. Considering the wide patronage that Open Source SDN has received from leading Networking organizations including Cisco, Juniper, VMware, etc through the Open Daylight project, we have also extensively discussed the business models with Open Source.While we ponder upon the monetizing opportunities for SDN, the technological aspects of SDN/NFV are beyond the scope of this paper.

3. RESEARCH METHODOLOGY

Adopting Secondary Research methodology, we have extensively explored the authentic sources including the annual reports, Standard bodies artifacts, and press reports to obtain the Key Findings. This has helped us in steering our discussion in the strategic direction.

4. SDN OVERVIEW

Traditional IP based networks were built to connect end users using hierarchical switches, routers, and other

devices in a distributed fashion. This design proved resilient and scalable in the past but this static and closed architecture is not suitable for the dynamic computing and storage needs of end users, who access the network more often and in more ways. As elastic cloud architectures and dynamic resource allocation evolve, and as mobile computer operating systems and virtual machines usage grows, the need has risen for redesigning network architecture.

Software Defined Networking (SDN) is a new approach to network architecture for automation and dynamic provisioning of service provider networks. It refers to separating the control plane from the data plane, incorporating programming capability in the network, and centralizing control while distributing the elements of data plane. With SDN, today's traditional and static network can evolve into an extensible service delivery platform which is agile to respond to changing business, end-user and market needs. SDN provides granular level control of the data and control plane, abstracting the underlying network infrastructure from end user applications as well as enabling optimization and higher utilization of the existing network. As a result, service providers can now build highly scalable and agile networks, whose business value outweighs the CAPEX required to implement SDN. Telco CXOs can leverage the following benefits of SDN:

Lock In - SDN architecture offers opportunity to unbundle H/W, OS, and application, and brings openness in a controlled ecosystem. By managing the network complexity through centralized management plane, operators cannot be held captive by any vendor.

Time To Revenue - Instead of deploying, configuring (policies based on traffic), and then using the network, operators can now reduce their 'Time to Revenue' from day one by deploying and using the network resources through programmable networks and by defining the network behaviors based on network traffic growth.

CAPEX–Operators can now reduce CAPEX by utilizing the underutilized network resources and by managing investment through pay-as-you-go model.

The discussion on SDN is incomplete without visiting NFV in brief. NFV, an initiative driven by ETSI Industry Specification Group aims to offer a new way to design, deploy and manage networking services, by virtualizing network functions. The network functions have been currently performed by proprietary dedicated hardware. NFV decouples these network functions such as DNS (Domain Name Service), NAT, firewall,intrusion detection, etc from dedicated hardware appliances, to run on software. By leveraging IT virtualization technology, it is designed to consolidate and deliver the networking components needed to support a fully virtualized infrastructure including virtual servers, storage and even other networks.

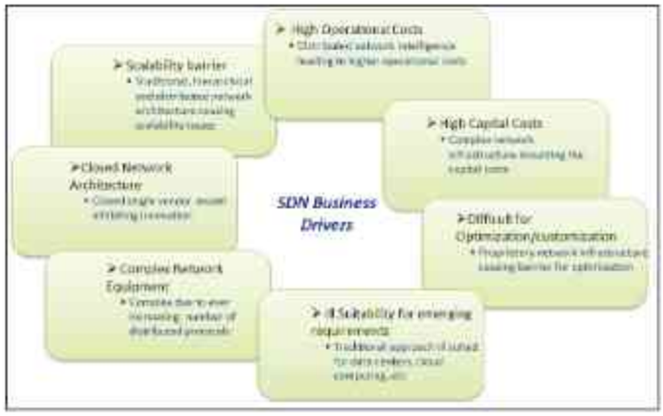
In short it could be said that while SDN is characterized by centralized control, separation of control and data plane and programmable network and deployed at data center or cloud, NFV is characterized by relocation of network functions from dedicated appliances to generic servers.

5. KEY FINDINGS

5.1. Business Drivers

These days, Telcos across the globe face the daunting task of effective management of CAPEX/ OPEX, and with fast evolving customer needs and service demands,it is increasingly difficult for Telcos to bring down their investment levels. From plain vanilla service of voice and SMS, Telcos now offer host of new data/voice/multimedia services, resulting in complex heterogeneous networks and applications, which, in turn, lead to a complex operating environment.Shown in figure 1 are business drivers of SDN.

Figure 1: SDN Business Drivers



6. VALUE CHAIN

As SDN matures and the hype becomes reality, uptake among SMBs (small and medium businesses) and large enterprises is expanding. Though SDN is still in its infancy, we believe it is an appropriate time to explore how the SDN value chain is taking shape and the battlefields that we need to be concerned about.

Figure 2. SDN Value Chain

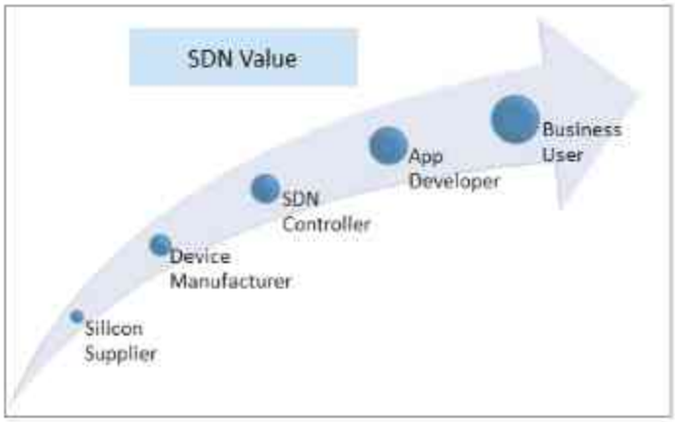


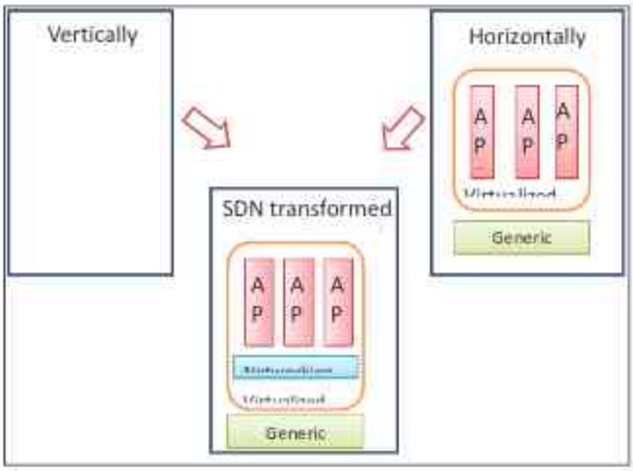
Figure 2 depicts the wide range of roles SDN providers play in the end-to-end SDN value chain. Dwelled in detail in earlier sections, the closed single vendor dominated system has opened to an open model, commoditizing and value adding at every stage, leading to generic hardware platforms with Silicon supplier and device manufacturer. App developers could develop modular independent applications, utilizing open source SDN controller. SDN controllers helps to provide centralized control of the network, which is overwhelmingly finding its application in Disaster Management Systems, etc. The SDN apps could be offered by business users either by bundling them as solution or by individual applications, throughvarious business models. This propels the network programmability and breed the desired openness of the network. While there could be security limitations, as SDN matures, the security aspect is also addressed.

7. Network Model Transformation & Monetization

SDN benefits Telcos or Service Providers through significant improvements in CAPEX/ OPEX, in network manageability, and in time required to deploy new network-oriented applications.

With traditional network architectures being ill-suited to meet the requirements of today's telecom operators, service providers, large enterprises, equipment vendors, and with the entry of new stakeholders such as data center & cloud/ web 2.0 providers, SDN is getting heralded as one of the most disruptive and revolutionary technologies to arrive into the market in recent years.

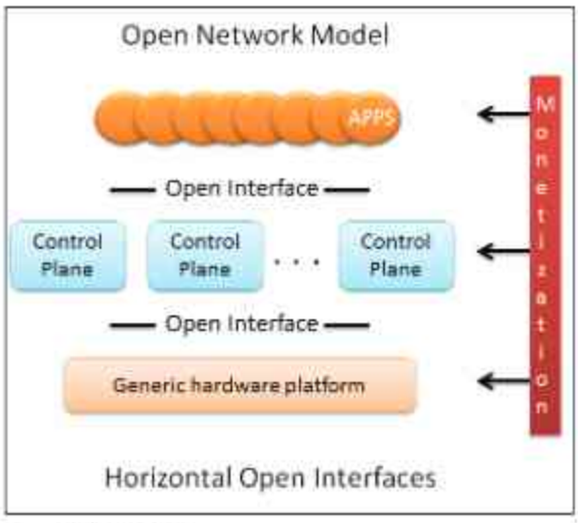
Figure 3: SDN Transformed Network Model



The traditional, vertically-integrated model characterized by proprietary software running on proprietary hardware is replaced by a horizontally-disaggregated model comprising generic hardware platforms based on general purpose processors, as well as an OS or hypervisor to deploy applications. This basically applies the standard computing model to networking.Based on transitions from hardware-centric to software-centric architectures, SDN transforms the business model for networking as depicted in figure 3.

Figure 4 depicts how OpenFlow/ SDN transforms the current computer networking ecosystem from a vertically integrated closed single vendor system to a horizontal open interface based ecosystem, opens up doors for monetization to various stakeholders, and facilitates new software licensing, business models and rapid innovation.

Figure 4: Monetizing SDN



Source SDNCentral

8. EXPLORATION

8.1. Business Models

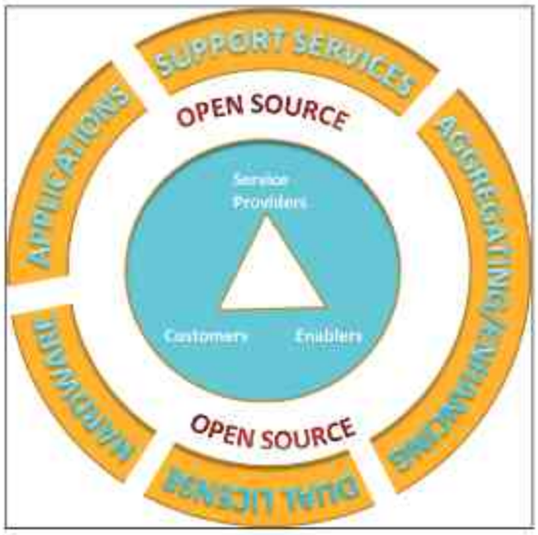
Since the SDN architecture offer flexibility of managing the complex network traffic effectively and efficiently, Telcos can experiment with multiple business models to offer unique services to complement the network capability.

- The open network architecture would trigger development of modular and independent Networking applications. These applications can be monetized and licensed individually or offered as a solution by bundling the applications. The Telcos or other stakeholders could further patronize them through SDN AppStores, taking the Smartphone model way, enabling new opportunities, for developing new applications that can shape how the network functions or is secured for end user applications or mission critical business applications. HP has foreseen this business opportunity and has created SDN app store, making the ability to innovate within networking possible.
- Taking the Server virtualization model, utilizing network virtualization technologies, multiple control planes could be developed and monetized as virtual applicances, that are independent of physical network and hardware. The Telcos could adapt one control place (Mobile Computing) in mobile networks, by pooling all the control software, thereby bringing down the infrastructure costs and making network management easier. On the other hand, this would bring the mobile analytics and big data mining technologies together, and enable new business models.
- The different capacities in the physical network could be licensed and monetized, through an on demand, pay-as-you-go model. This would ensure optimized utilization of network resources and better service elasticity.
- It can further be explored to deliver SDN as subscription service out of cloud to the existing equipment. An organization could build controller that is external to the network, build a logical network as an overlay over the Internet, and migrate some of the network function into conventional software.
- One such example could be delivery of network Management functionality as SaaS. If this software is delivered in the form of multi-tenant, single instance shared service, the value proposition of SaaS can be dramatically improved.
- SDN startups could also monetize through embedded model which is hardware based. System vendors could offer Controller and Open APIs for free and price the hardware such that it covers the cost of Software development. The software solution is concealed within the hardware price, technically. The benefits of this business model is that the hardware stays in the network for a long time, and the additonal add on software features, applications and upgrades can be sold at increasing profits. This model is suitable both for SDN start upsand networking infrastructure vendors that have hardware based solutions bundled with the Controller and applications.This model is seen predominantly successful, as the end users are favoring fully integrated software and hardware solution, much against piecing the components together themselves.
- Yet another innovative model is Cloud-Based or Application Hosting Model. This model is per virtual machine (VM) and is time based, similar to the Amazon usage-based billing system. Use a number of VMs within a certain period, and the price scales with the usage. There is no tie to specific hardware. It may sound like a low-cost entry approach, but this is likely to be one of the most expensive models because the complexity to evaluate the year-end cost is quite difficult. Additionally, it is likely tobe expensive for the typical enterprise to embrace, given large-scale virtualization deployments are in the very early stages.

9. OPEN SOURCE BASED BUSINESS MODELS

Open source plays significant role in the success of technology adaptation and formulating ecosystem. SDN with Open source opens a plethora of business opportunities. The flatter architecture of SDNs improves interoperability and creates opportunities for new players - the Enablers encompassing Web 2.0/ cloud providers, data center providers, application developers, and equipment manufacturers can deploy the open source, and by adapting a business model integrated with those of service providers, can enhance operator agility, lower capex, and disrupt the vendorlandscape.

Figure 5: SDN Open Source Business Models



9.1. Applications on Top of Open Source

Several different types of business models could be used to generate financial returns using open-source SDN controllers.

Organizations in the Linux world sell a range of commercial application offerings, ranging from desktop tp database that run on open-source Operating System. Standard Application Programming Interfaces (API) are the key enablers, which avoid the need to re-write applications for different hosts. Linux's standardized APIs abetted the rapid adoption of Apache Web Server, sometimes called the Linux "Killer app".

The paid-for-license SDN & NFV applications that run on top of Open Stack or SDN controllers can be offered and form the basis for a business.

9.2. Support Services

Companies built business model by providing support and services to opensource users, with the most successful being Linux. Redhat, a billion dollar company has been successful with such a business model.

Similar business opportunity lurks for SDN/NFV. Though SDN/NFV skills are not pervasive today, this model could be adapted as the SDN ecosystem picks up momentum.

9.3. Aggregating/ Enhancing

In the early days of open source Operating System evolvement, organizations offered bundled offerings. They exploited the fact that a Linux distribution comprised of many libraries and applications besides the Kernel. Companies made their own enhancements, and value adds and bundled them into a distribution. For example, Linux was a command-line driven, and it did not originally come with graphical management tools. Bundling of such tools provided extra value, and formed basis for their business model.

Borrowing this model, the various SDN components could be enhanced and aggregated by bolting together an OpenFlow Controller, OpenFlow enabled switch, such as Open Switch, virtualization technology, such as OpenStack, coupled with open source network functions such as firewall, and load balancer, and offer a low cost switch or middle box. This could probably open a new breed of network elements.

9.4. Dual License

An open source compatible business approach that is gaining momentum is Dual licensing. Dual licensing model offers the advantage of both open source and commercial approaches. Dual licensing is widely adopted to support free software business models in a commercial environment, in which the open source license allows downloading and running software at no charge. The service, support, and functional enhancements are provided through commercial license. A popular example of this type of business model is MySQL database by Oracle.

Dual licensing is gaining prominence in SDN space. Big Switch Network has its open source "Project Floodlight" and a commercial version "Big Network Controller"

9.5. Hardware

The system vendors, for example Switch companies, promote open source if it enables their equipments in providing a complete solution.This is seen predominantly in Linux world, where most of the home routers run OpenWRT, a Linux variant, tailored to the modest hardware in those boxes by stripping middleware and desktop applications.

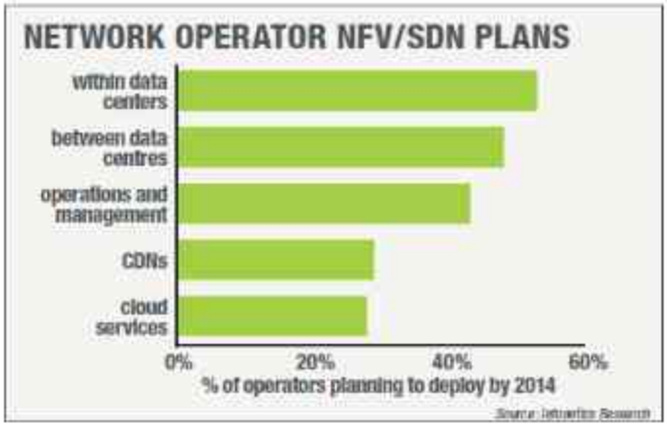
Equipment companies could focus on requirements relevant to devices in the field, while providing an open-source SDN stack that enables the device to act as a hybrid switch.

On the other hand, an SDN software company could opt for open source hardware design, to stimulate a community of builders to provide more platforms for their software.

10. Operator Success Stories

SDN has been discussed tremendously, it has moved from being theorotical to deployment mode. While there have been many SDN products and solutions by various vendors and IT players, it has been observed that the operators are cautiously embracing and formulating roadmaps. Currently, SDN is positioned for deployments within and between data centers. We could observe operators applying SDN for core and access networks. Coming years could witness SDN being utlizied beyond data centers.

Figure 6



SDN has picked up momentum with Telcos in mature markets such as America and Japan. Recently AT&T has announced a vision Domain 2.0 based on SDN & NFV, with a road map extending till 2020.

Another instance being NTT Docomo deployment for disaster management. It is worth to discuss how Japan Telco, NTT DoComo has applied the use of SDN in Disaster Recovery, by taking a leaf of their learnings during 2011 earthquake. The earthquake in Japan had critically impacted the communications and only 5% of call attempts were successful. It was observed that, surprisingly streaming videos and media access was normal as the network was statsicaaly configured to provide high quality media services as per the organizational goal. This is best explained in fig 6. Networks need to support contradicting demands during normal and disaster times. NTT Docomo achieved this by SDN based control of system resources, reallocating resources based on the demand. Fig 7 explores on the architectural aspects of SDN based disaster management system.

Figure 7

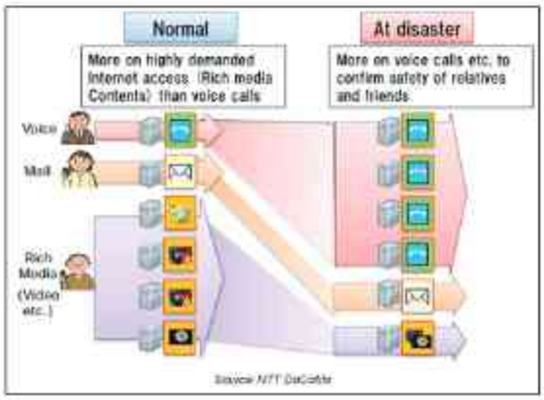
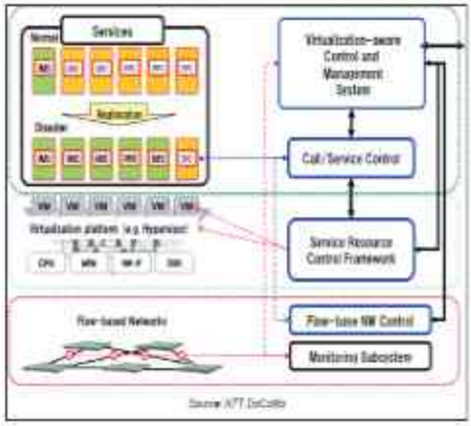


Figure 8



11. SDN Challenges & Risks

While SDN moves from hype to reality, it presents many challenges and risks. Few barriers have been identified by network analysts which include lack of service control software, Multivendor network control, Managing control traffic, Boundary functions are needed.

Coupled with this are few security risks. The layered hardware boundaries such as firewalls are removed by the centralized control in the SDN controller. The centralized controller only need to be compromized, to gain access to the entire network. New areas like network controller, its protocols and APIs are also introduced for attack, due to

decoupling the control plane from data plane.

We believe that as SDN matures and evolves slowly, the challenges are addressed, paving way for adaptability of SDN.

12. CONCLUSION

Though SDN has been in making since 2008, and industry has been skeptical about SDN initially, it has picked up the momentum and many leading system vendors, carriers and over the top providers have started strategizing around SDN. While SDN combines innovations in technology and in business models, it is fascinating to see that business models from other domains are becoming applicable in the network domain - capitalizing on the opportunities in SDN with potential to change the business of networking.

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CSPs in the World of OTTs: How Would they Win the Battle?

Brajesh Ranjan Sinha* Surendra Nath Mallick**

**Business and Operations Consultant, Ericsson, India. E-mail: brajesh.r.sinha@ericsson.com*

***Business and Operations Consultant, Ericsson India. E-mail: surendra.nath.mallick@ericsson.com*

ABSTRACT

OTT (Over the Top) players provide services carried over the networks deployed by communications service provider (CSP) without it being involved in planning, selling, provisioning or servicing them. CSPs cannot book revenue directly for these services and are left only with the revenue generated for the data that is transferred. CSPs thus fear that they would eventually turn into mere dumb pipes in the future telecommunication ecosystem. The explosion of smartphones has helped operators increase Average Revenue Per User (ARPU) by getting people subscribing to data services, but it has also started to threaten their traditional revenue model due to increase in the usage of OTT applications such as WhatsApp, Google and Facebook. Gradually people world over are using WhatsApp more for texting than the traditional short messaging service (SMS). Similar trends are visible in music downloads, video chat and even voice calls.

This paper primarily discusses about the various segments of OTT players, the current services and potential future services offered by them. It would also talk about the impact of OTT players on the CSPs' traditional business of providing voice, data and value added services. It would present the value chain analysis for a telecom operator and various strategies that an operator can adopt to counter the threats from OTT players. Towards the end, it would present specific recommendations for CSP's based out of India.

Keywords: OTT, SMS, CSP, Revenue Loss

1. INTRODUCTION

OTT (Over the Top) players provide services over the networks deployed by communications service provider (CSP) without being involved in planning, selling, provisioning or servicing them. CSPs cannot book revenue directly for these services and are left only with the revenue generated from the user for the data that is transferred. With increasing penetration of smartphones and tablets, OTT players are seeing tremendous opportunities to create and provide value to the customers. Today, one can make calls, send text messages, photos, videos etc, watch online videos, play online games, group chat; all these without paying anything more than just for the data transferred through the operator's network. Most of these services are the main VAS of CSPs, hence their revenue stand to fall heavily because of OTT players. CSPs are strategizing collaboratively as well as aggressively to counter the threat posed by OTTs. These measures have produced mixed results. Still as of today operators have no clear roadmap to counter the threat posed by OTT players. This paper tries to throw some light on the various aspects of this issue. Main focus of this paper is on the text messaging service that has been a traditional cash cow for the operators but now is under serious threat from OTT players' free message applications.

In our opinion it's not possible for operators to completely stop the march of OTT applications. Given the fact that new ideas and new products naturally replace older products, telecom operators should brace themselves for such a situation in future. This paper is an attempt to analyze and recommend ways to help them retain their lost ground and pose a stiffer competition to OTT players.

2. LITERATURE REVIEW

This topic has been a growing area of concern for CSPs over last few years and though there have been publications emphasizing the impact of the OTT players (Nitesh Patel, Nov 2013; James Chavin, Aadil Ginwala and Max Spear, Sep 2012), there have not been any attempt to look at this phenomenon at the global level, discuss the reasons behind this holistically and suggest

a comprehensive list of options available to operators. Also there has not been any attempt to explain how rise of OTTs will impact Indian operators. This paper discusses the impact of OTT players on CSPs across the globe, with a significant emphasis on the various strategies that CSPs can adopt to counter the emerging threat from these players. This paper also analyzes the unique scenario in India and provides recommendations for Indian operators as well.

3. Facts and Figures

3.1. OTTs and their user base

The table below is a compilation of most popular OTT applications in some of the most populous countries.

Table 1: Popular OTT Applications

Country	*Most Popular OTTs*
India	WhatsApp, GoogleTalk, Facebook Messenger, WeChat
China	WhatsApp, Line, WeChat, QQ2012, Fetion2013
USA	WhatsApp, Skype, Line, Facebook Messenger, Kik Messenger
UK	WhatsApp, Skype, Facebook Messenger, Kik messenger, InstaMessage
Brazil	WhatsApp, Skype, Facebook Messenger, Kik messenger, InstaMessage

Source: Nitesh Patel, Nov 2013

Shown below is the number of registered users (or monthly active users) and usage statistics for some of the popular OTTs.

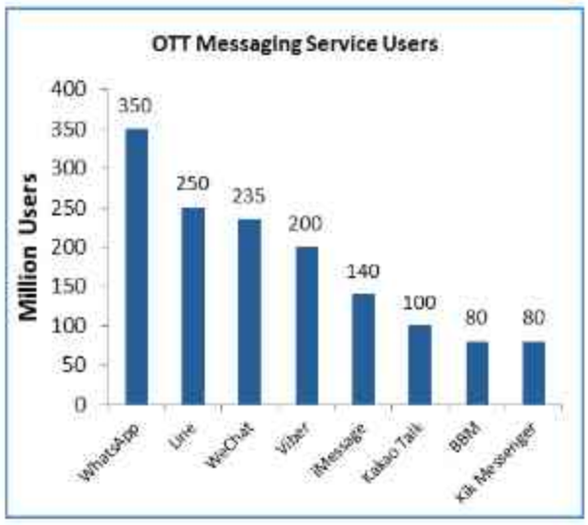
It is evident that OTT applications have made a strong connection with users. Subscribers are using them extensively with some of the OTTs like WhatsApp transacting approximately 10 Billion messages daily.

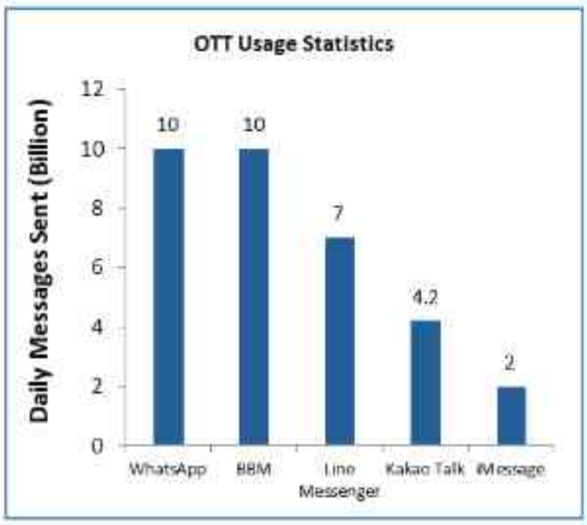
3.2. Region-wise Data on Operator and OTT Text Messaging

Asia Pacific, Middle East and Latin America still see growth in traditional text messaging (SMS) whereas other developed regions e.g. North America and Europe show saturation or even fall in SMS traffic. OTT text messaging is growing extremely fast in all the regions. Following are the details about how OTT text messaging has impacted SMS traffic across regions:

- Almost two third of European countries have either stable or declining SMS traffic with only remaining one third showing any growth.
- In Asia-pacific, only India and China show some amount of organic growth.
- While US shows decline in SMS traffic, Canada still looks like a healthy messaging market.
- Latin America still shows an upward trend in SMS usage. So far OTT messaging has not made much dent in Latin American SMS market

Figure 1: OTT Usage Statistics





Source: Wireless Media Strategies, Nov 2013

- Countries from Africa and Middle East still exhibit a healthy growth in SMS market.

For further details please refer to facts and figures available in Appendix I.

4. FACTORS DRIVING OTT GROWTH

For most of the countries, the factors discussed below work in conjunction with each other and cannot be ascribed to the decline of SMS number independently.

4.1. OTT Applications as Cheaper Alternatives

While OTT clients are almost free of cost traditional messaging rates are relatively much expensive. WhatsApp users only pay $0.99 annually from the second year of use.(FAQ, WhatsApp official website). Other popular applications Line, We Chat, Kakao Talk do not charge anything from the users. These OTTs do have virtual currencies to be earned and used for in-app gaming etc but there is no physical money involved. On the other hand, for every Byte of data transferred through operator's network subscribers pay the highest while sending text messages. It forces them to look for cheaper alternatives – bundled plans or OTT applications – wherever possible.

4.2. Increasing Smartphone Penetration

Smartphones have made an abundance of mobile apps and plenty of OTTs accessible to users thus transferring the control from operators to mobile application developers. Users don't need to wait for provisioning and activation of a service as it is readily available as a feature in an OTT.

As per Portio research out of top 10 countries with highest smartphone penetration, 5 have already seen significant drop in total SMS messaging traffic between 2010 and 2012 (ranging from 11% to 24%), 2 have witnessed stagnation and SMS traffic growth is very slow, 2 of them are still seeing good growth in SMS traffic and no concrete data is available for 1 (Mobile Messaging Futures 2013-2017, Portio Research, July 2013.)

For all the countries rated by McKinsey as high risk markets (James Chavin, et al. Sep 2012) following is the smartphone penetration trend in last three years (Scott Bicheno, Dec 2012. Global Smartphone User Penetration Forecast by 88 Countries: 2007 to 2017).

Table 2: Smartphone Penetration & CAGR in High-Risk Markets

Country	*Smartphone Penetration*			
	2010	*2011*	*2012*	*CAGR*
Netherlands	19.41%	28.24%	38.57%	41.61%
South Korea	14.04%	38.29%	67.62%	120.76%
Japan	26.83%	31.48%	39.92%	22.02%
Spain	17.41%	25.89%	35.14%	42.32%
Germany	17.30%	26.21%	36.08%	44.49%
Switzerland	19.74%	29.44%	36.47%	37.41%
United Kingdom	28.36%	37.44%	46.59%	29.14%
Singapore	24.44%	38.41%	53.07%	50.73%
Russia	7.90%	12.18%	17.87%	51.04%

Source: Scott Bicheno, Dec 2012

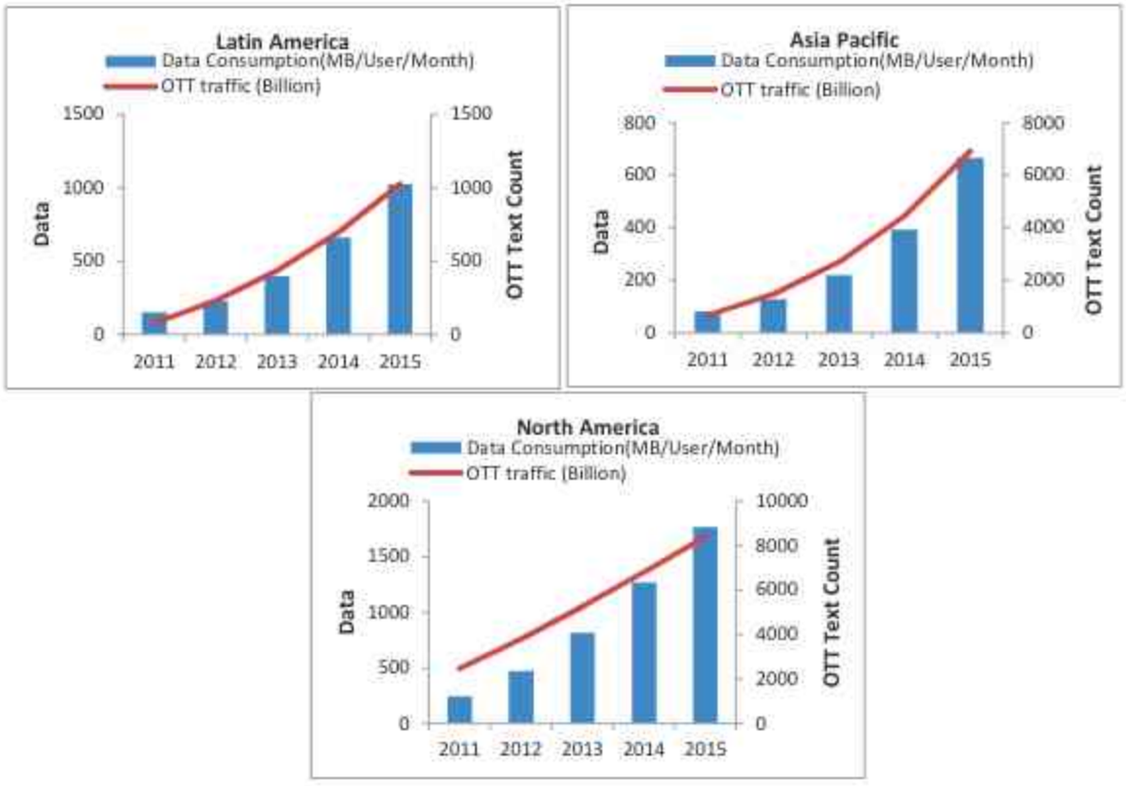
It is evident from the table that there has been a sharp rise in smartphone penetration in all the above countries – CAGR as high as 120%in some cases. This has certainly contributed to the increasing use of OTT applications and declining SMS usage.

4.3. Improving Mobile Internet Connectivity

High speed mobile data connectivity, from 3G and 4G adoption is within reach of most of the consumers. In countries having 3G or better wireless connectivity subscribers are always online through Mobile phones. A subscriber connected through smartphone is more likely to send a text message using an App than using traditional SMS due to better user experience. Figure 2 shows the trend between data consumption and OTT traffic for some regions.

These charts depict a clear pattern – with every passing year OTT text messaging is growing along with growth in data consumption.

Figure 2: Data Consumption and OTT Traffic



Source: Portio Research, July 2013,; ABI Research, September, 2013

4.4. Changing Demographics

Demographic changes are another important factor in many countries driving OTT messaging growth. Youth are not satisfied with simplistic SMS when they have options to communicate with much richer and fun-filled options such as smileys and emoticons provided by OTTs. Young generation also finds it cheaper to do so by spending just for data.

4.5. Abundance of Features Provided by OTT Applications

OTT applications provide plethora of features such as sending text messages, pictures and videos, group chat, rich stickers and emoticons, presence and location information, video call etc. Most of these applications such as WhatsApp are cross-platform applications. Furthermore, OTT applications allow users create their visual profile. One can update WhatsApp status everyday

Table 2: Snapshot of Popular OTTs' Features

Sl No	*OTT Application*	*Features*
1	WhatsApp	Individual Messaging, Group Messaging, Photo Video and other media Sharing, Presence information.
2	Line Messenger	Individual Messaging, Group Messaging, Photo Video and other media Sharing, Presence information, stickers, VoIP, Video Calling, in-App games.
3	We Chat	Individual Messaging, Group Messaging, Photo Video and other media Sharing, Presence information, VoIP, Group Calling
4	Kakao Talk	Individual Messaging, Group Messaging, Photo Video and other media Sharing, Presence information, VoIP, Group Calling, in-App games.
5	Viber	Individual Messaging, Group Messaging, Photo Video and other media Sharing, VoIP, Video Messaging.

with what he/she is doing, what was his/her latest purchase, thus catering to one's alter-ego. Such features bring OTT applications closer to popular social networking sites such as Facebook thus rapidly fueling its adoption in certain segments of users. It's not difficult to see that traditional messaging doesn't stand a chance when compared with the features provided by OTT applications.

The table below gives a snapshot of the features provided by some of the popular OTTs.

4.6. Network Externality

Another important factor driving OTTs' growth is 'Network Externality'. As more people use an application, a network of users is created. As the network grows, value provided by the application to its users grows exponentially. Once a critical mass is achieved by the network, being outside this network is quite inconvenient or disadvantageous for users. Hence they stick with the network and it keeps growing with more people joining in.

An example of this is South Korea where two of the popular apps are Kakao Talk, with 70Musers and Tic Toe Plus with 2M users. To keep themselves connected to bigger mass new joiners prefer Kakao Talkto TicToe resulting in much healthier growth of Kakao Talk than TicToePlus. As per Strategy Analytics, between April-2011 and April-2012 Kakao subscribers grew from 10M to 50M adding approximately 3M per month. Between April-2012 and Dec-2012 Kakao added 20M subscribers growing by approximately 2.5M users per month (Nitesh Patel, Nov 2013).

5. Strategies and Recommendations

Realizing the imminent threat from OTTs to their traditional services, particularly to SMS, CSPs have started taking counter steps ranging from blocking to promoting them. This section looks at possible strategies and recommendations that can be adopted by CSPs in dealing with OTTs.

5.1. Collaborative Strategy

- **Introducing Innovative Data Plans**: CSPs can offer data plans at a lower price specifically designed for OTT applications. These plans would increase mobile data adoption and lead to CSP's gain in the longer run.DiGi (Malayisa), SingTel(Singapore), RCOM and Tata Docomo (India)offer such plans allowing subscribers to use WhatsApp without subscribing to full-fledged data plans (WhatsApp – 5 Days RM5 (100MB) Plan Dec 2013, Digi Official Website Dec 2013; Get WhatsApp & Facebook at just Rs.16 a month!, Reliance Communications Official Website Dec 2013; Tata Docomo launches unlimited WhatsApp data packs, TOI Article Dec 2013; Prepaid Mobile Social Plans, Singtel Official Website Dec 2013)
- **Launching New Collaborative Services**: CSPs can have exclusive partnerships with OTTs to offer differentiated services. For example catering to specific needs of immigrant community to keep in touch with their contacts in native country. 3 Hong Kong offers "WhatsApp Roaming Pass" enabling users to freely use WhatsApp service across 113 destinations and 150 networks worldwide for a daily fee (WhatsApp Roaming Pass, Three (HK) official website, Dec 2013). KDDI, Verizon and 3 UK offers services allowing users to make local/international calls using Skype at a discounted price. (KDDI and Skype partner to bring a new communications experience to Japanese consumers, KDDI official website, Dec 2013; Skype Mobile FAQ, Verizon official website Dec 2013; 3 UK makes new Skype push, Total Telecom Dec 2013). These would help CSPs differentiate its offerings while opening new revenue streams.

5.2. Aggressive Strategy

- **Blocking OTT services**: CSPs might also seek support from regulators to block/surcharge OTT services. Since it's against the principle of network neutrality, operators might have to be cautious in adopting this approach.

  Till date only South Korean regulator has agreed to such demands. The Korea Communications Commission has allowed SK Telecom, KT and LGU+ to charge their customers extra fees to use VoIP apps or block their use entirely. (Charging extra for OTT: good luck with that, Telecom Ramblings 2013)
- **Acquisition and consolidation of OTTs**: CSPs might also think of acquisition, if possible, to gain access to the huge volume of users OTT application has already attracted. This would allow the CSP to

have usage pattern, location and many other details of a large number of users. With the use of analytics this information about customers can be used for developing better offerings. Such consolidation would also ensure that CSPs have to compete against lesser number and type of players. Here it's imperative to mention that before embarking upon such aggressive strategy CSPs must perform adequate financial due diligence.

5.3. Opportunistic Strategy

- **Charging premium for OTT services**: CSPs may also look at the growth of OTTs as an opportunity to improve data revenue. Some CSPs had introduced data plans in the past charging higher if consumers avail OTT services. Telisonera in Sweden and Spain introduced a data plan charging consumers extra for VoIP calls (Skype, Google Talk etc). Later they quashed it and simply raised their standard data plan rates to account for lost voice traffic revenue (Telia Sonera drops extra VoIP fees but raises rates, A gigaom article Dec 2013).

5.4. Competitive Strategy

- **Launching own OTT application**: CSPs may launch their own OTT applications with comparative features to prevent subscribers from migrating to other alternatives. These apps can be developed incentivizing users into consuming other services e.g. linking it with SMS allowing user to send text message without having to worry about receiver's phone type – smartphones with the app receive it inside the app whereas other phones receive as text message.

  Orange's Libon and Telefonica's TuMe/TuGo are examples of OTT applications introduced by CSPs (Now your number is truly mobile, O2 official website Dec, 2013; Orange's Libon official website Dec, 2013).They aim to generate revenue through advertising and offering premium services.

- **Launching an all-feature interoperable App**: In collaboration with GSMA many operators have come together to launch an interoperable rich communication solution named JOYN. Movistar, Orange and Vodafone in Spain; Deutsche Telekom, T-Mobile, Vodafone in Germany; Orange in France; KT and SK Telecom in Korea are trying their best to popularize it (Joyn News, Joyn official website Dec, 2013). As more operators join hands and promote it, JOYN might gradually turn into a solution for CSPs.

5.5. Further Recommendations

In addition to the above strategies CSP's can follow the recommendations given below.

- The CSPs can collaborate with OTTs to augment their portfolio reducing time to launch new services e.g. Video calling. A feature-rich Video Calling app would attract subscribers and boost data revenue. A CSP can also offer these services through video calling Booths where it can enhance QoS by combining the dual advantage of state of the art infrastructure and rich features of OTT Application.
- Adoption of OTTs has fuelled growth in wireless data usage. CSPs should perform a detailed assessment for SMS revenue decline due to cannibalization against data revenue increase due to uptake of wireless data plans. They may price data services in a manner compensating average loss in SMS revenue by average gain in data revenue.
- Countries where smartphone penetration is high, CSPs should not adopt aggressive strategy of blocking OTTs in their network. With growing spread of Wi-Fi hotspots and rollout of small cells, they may even lose data services subscribers. A better approach would be to provide additional advantages to own customers thus incentivizing their loyalty.
- Countries where smartphone penetration is low and increasing at a modest rate CSPs should adopt a competitive strategy of launching their own App. Subscribers can make a decision on the available options without taking network externality as a factor. Such Apps can be a combination of messaging Apps e.g. WhatsApp/Viber and existing Apps provided by operators for managing user accounts, bill payments etc. To drive adoption of the app CSPs may devise innovative plans such as texting/calling from inside the app would be charged at a lower rate.
- Countries where majority of subscribers have moved to OTTs, CSPs should even consider offering SMS free of cost or at a very low price. It might take away some of its revenue but would most certainly compensate the loss by attract new subscribers from competitors.

- CSPs should promote apps using text messaging as their intrinsic features e.g. SOS, an Android application. Using this app a user in emergency can quickly send pre-configured text messages to contacts. Such apps rely only on operator's SMS hence must be promoted by CSPs. Growth of such Apps would ensure a steady SMS revenue to the operator.
- Most of the OTT applications would certainly try to earn money in future in some way or the other, most likely asking users to pay up. Operators being indispensable part of this value chain can innovatively demand OTTs to share this revenue e.g. part with some of the revenue if data transferred is more than certain limit. CSPs can even help OTTs with their billing through its own billing and charging systems. Even users would find it convenient paying to OTTs with their airtime.
- CSPs can also focus on other segments in order to augment their revenue and substitute for the declining profits due to emergence of OTT players. A relevant example is recent acquisition of DirecTV by AT&T (DirecTV's acquisition by AT&T, AT&T official website, Jul 2014). This acquisition has provided AT&T access to DirecTV video services which it can bundle and augment its triple-play offerings.

6. OTT LANDSCAPE IN INDIA

India is amongst the countries where until recently CSPs were not much impacted by the emergence of OTTs primarily because of below reasons:

- Smartphone penetration in India is only 6%, lowest among top 30 smartphone markets (India has 67M smartphone users; A Tech circle Report Dec, 2013)
- Mobile broadband penetration is quite low, estimated to be 4.9% in 2012 compared to123.3% in Singapore and 113.1% in Japan (The State of Broadband 2013: Universalizing Broadband, A report by the Broadband Commission,Sep 2013)
- Non-voice (SMS, data etc.)revenue is only 9.59% of gross revenues compared to close to 50% in USA and UK. (Top 12 Predictions for 2012 and Beyond. A CCS Insight Report. Dec 2013)
- Messaging rates in India are amongst the lowest in the world and unlimited messaging plans cost lesser than data plans.

Because of these reasons most industry analysts e.g. McKinsey rate India as a country with low risk for operators from OTTs (James Chavin, Aadil Ginwala and Max Spear, Sep 2012). Recent steps taken by some operators further substantiate this fact- Aircel partnering with Nimbuzz to offer free data, RCom offering unlimited Facebook messenger for Rs.16/month (India Telecommunications Report, March 2014)

This trend may soon change as smartphone penetration is increasing rapidly with year-on-year growth being 52%, second fastest in the world. For the first time, a major CSP in India accepted that OTT messaging apps are becoming a threat to non-data VAS revenues (Free Messaging Apps A Threat To Non-Data VAS Revenues – Idea Cellular, A Medianama Report, Dec 2013).

Unlike in developed nations, share of non-voice revenue is decreasing in India. Since profit margin on non-voice services is higher this is not a favorable situation for CSPs. They expect that increasing smartphone penetration and improved wireless connectivity would increase non-voice revenue. Since data plans are costlier than SMS plans this would not have large impact on SMS revenue.

Indian CSPs should take OTT growth as an opportunity to increase mobile broadband subscription and even collaborate with OTTs to offer differentiated services. This would benefit them in following ways:

- Improved non-voice revenue, leading to better profit margin.
- Differentiated services, leading to increased market share.
- Improved subscriber loyalty, leading to reduced churn

7. CONCLUSION

It is evident that operators in many parts of the globe are feeling the heat due to rise of OTTs. Due to increasing smartphone penetration, improving wireless connectivity and other inter-connected drivers there is no easy escape for them. Operators must accept that OTT applications are here to stay and its best for both the parties to live symbiotically. Operators should create a harmonious relationship with OTT players thereby ensuring that they recover their losing revenue and also keep text messaging services relevant even in future.

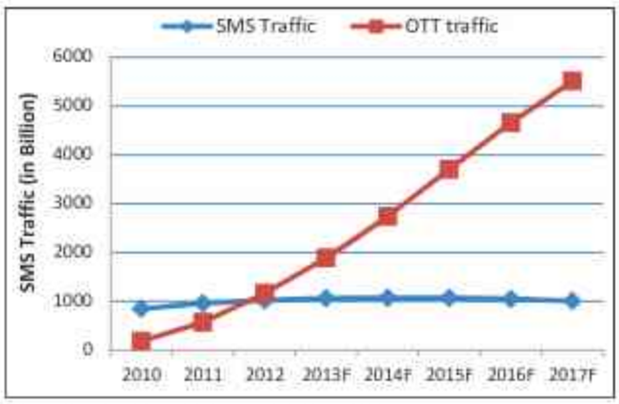
8. APPENDIX I

Here we look at the comparative charts on both types of traffic for various regions. Data has been forecasted for 2013 and beyond.

8.1. Europe

In Europe mobile subscriber's adoption of OTT messaging has a significant impact on SMS traffic. McKinsey has categorized Spain, Netherlands, Germany, Switzerland, Russia, UK as high risk countries in terms of threat from OTT applications (James Chavin, et al. Sep 2012)

Figure 3: Messaging Data for Europe

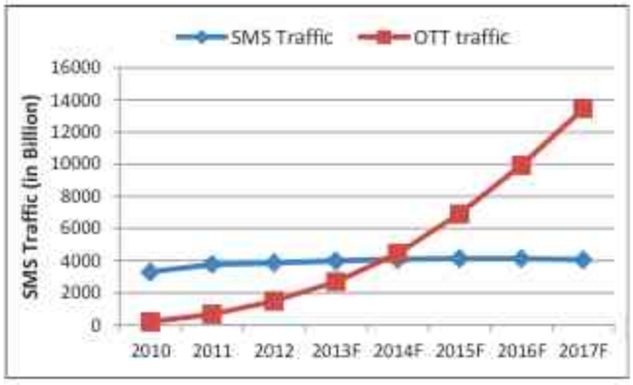


Source: Portio Research, July 2013

8.2. Asia-Pacific

In Asia some of the large SMS markets are China, India, South Korea, Philippines, Singapore and Japan. McKinsey has rated South Korea, Japan and Singapore as high risk countries, meaning OTT messaging in these countries has reached such a high level that it is causing material threat to SMS volumes and revenue.(Other markets where some amount of organic growth was visible until recently are China and India. Even these markets have started leveling off in SMS traffic since H2-2012 (Mobile Messaging Futures 2013-2017, July 2013. Portio Research).

Figure 4: Messaging Data for Asia-Pacific

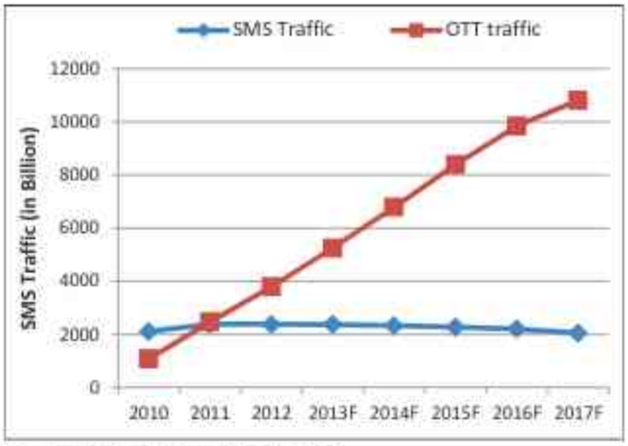


Source: Portio Research, July 2013

North America

The US and Canada are two biggest SMS markets in the world. Industry experts believe that US texting market has reached its peak in 2011. Canada, rated by Portio research as world's second highest SMS Usage market (Mobile Messaging Futures 2013-2017, July 2013. Portio Research), still looks like a healthy messaging market where organic growth is visible clearly. Despite this there has been a good growth in WhatsApp usage as well.

Figure 5: Messaging Data for North America

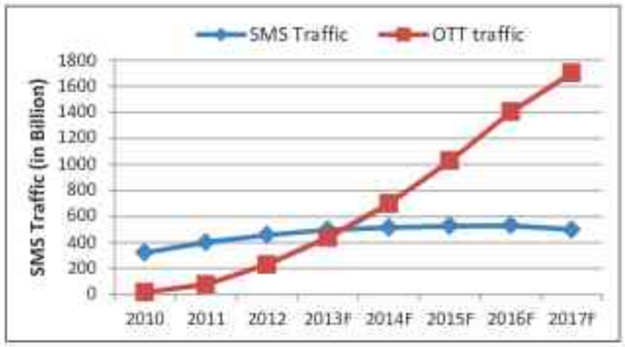


Source: Portio Research, July 2013

8.4. Latin America

Latin America still shows an upward trend in SMS usage. So far OTT messaging has not made much dent in Latin American SMS market. Market analysts predict that it would take few more years before Latin American countries see SMS market growth flattening out. Organic growth would continue even after OTT messaging finds a healthy acceptance among the subscribers.

Figure 6: Messaging Data for Latin America

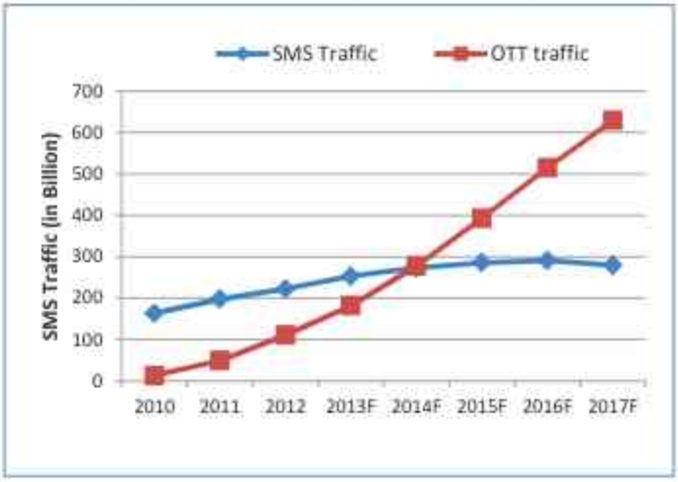


Source: Portio Research, July 2013

8.5. Middle East and Africa

Countries from Africa and Middle East still exhibit a healthy growth in SMS market and would continue in near future. As smartphone penetration increases, it is expected that SMS market would gradually be cannibalized in the price sensitive African continent. In Middle East Saudi Arabia, Israel, UAE and other matured markets have witnessed high growth in penetration of smartphonesand operators have observed steep decline in SMS traffic (Mobile Messaging Futures 2013-2017, July 2013. Portio Research)

Figure 7: Messaging Data for Middle East and Africa



Source: Portio Research, July 2013

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AUTHORS' PROFILE

Brajesh Sinha is a Business and Operations Consultant with Ericsson India. He has over 9 years of consulting experience in Telecom and IT domain having worked with ICT companies across the globe. His main areas of interest include emerging trends in Telecom and ICT industry, Business Processes Discovery and Re-engineering, Telecom Process design and development, IT strategy and IT Service management (ITSM). Brajesh holds a Bachelor in Technology from Indian Institute of Technology, Kharagpur, India and an MBA from Indian Institute of Management, Lucknow, India with Major in Strategy and Marketing.

Surendra Nath Mallick is a Lead Business and Operations Consultant with Ericsson India. He has more than 9 years of experience in IT Consulting, Business Analysis, Program Management, Change Management and Client Engagement functions in IT Service Management (ITSM) and outsourcing advisory services. He has delivered projects in business process re-engineering, business capability transformation, and change management and performance improvement. Surendra holds an MBA degree, with specialization in Operations and Strategy, from IIM Lucknow.

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Internet of Things The Next Frontier of a Networked Community

Ninad Jadhav

Principal Architect, Tech Mahindra Ltd. Sharada Center, Erandwane, Pune, Maharashtra. India.
E-mail: ninadj@techmahindra.com

ABSTRACT

The 'Internet of Things (IoT)' refers to the connected world of 'Things', often driven by intelligence, using information and communication technologies (ICT) and providing services to the society. 'Things' are not just an object of the physical world (physical things e.g. sensors, devices etc), but it could also represent objects of the information world (virtual things), which are capable of being identified and integrated into communication networks. In the world of 'Internet of Things' ordinary common place objects would have the ability to connect and communicate with other objects, people and systems. The 'Things' and the controlling processes would be able to analyze information and perform actions as well. 'This amalgamation of devices, software, communication and data would provide unforeseen services to the connected world. This technology is expected to bring benefits in various disciplines such as logistics, energy management, education, agriculture, health care, etc. Service providers have already started to offer IoT services for niche segments such as automotive, energy, utilities, transport, logistics and retail. However, IoT standards are still evolving and there are many challenges that need to be overcome before wide spread global adoption can be seen.

This paper provides an overview of the 'Internet of Things' covering aspects such as, the key facets of IoT, representative architecture, worldwide focus on IoT, market adoption and the future of IoT.

Keywords: M2M, Smart Objects, Internet of Things, IoT, IoE

1. INTRODUCTION

The term "Internet" refers to the interconnection of computer networks globally using the Internet protocol suite (TCP/IP). This inter-networking of computers is used to deliver a variety of services such as World Wide Web (WWW) services, files sharing, internet radio etc. The initiation of services is typically driven by humans through networked computers or by computers themselves and the services are typically serviced by networked computers. When machines utilize the network for communicating with remote machines or applications for the purpose of realizing some service, it is typically refered to as machine to machine (M2M) communication. M2M communication need not necessarily be over the Internet, but may also use varied networking technologies such as cellular, Bluetooth, Zigbee etc. Advances in embedded systems and miniaturization have made it possible for common place physical objects to have computing & communication capabilities and these are termed as 'smart' objects. When such 'smart' objects start to connect over the network and communicate with other objects, people or systems by augmenting such interactions with contextual information such as time, location etc. and exhibit 'intelligent' decision making, the machine to machine communication evolves in to the 'Internet of Things' (IoT).

2. IOT LANDSCAPE

Many different terms have been used to refer to the concept of 'The Internet of Things'. Physical Internet, Ubiquitous Computing, Ambient Intelligence, Machine to Machine (M2M), Web of Things, Internet of Everything (IoE) and Pervasive Internet are few of those. In general, these refer to Intelligent Systems involving 'Smart' objects that are connected to each other over some communication mechanism and cater to some service in coordination with humans and machines.

The below table lists some of the services where principles of IoT are applied.

Table 1: Sample IoT Services

Service Category	*Service Examples*
Smart Cities	Monitoring of parking spaces availability in the parking area. Intelligent and environment aware street lighting.
Smart Metering	Energy consumption, monitoring and management.
Security	Detection of gas levels and leakages in industrial environments.
Retail	Supply chain management – tracking supplies and storage.
Smart Homes	Home automation – video surveillance, light control etc.
Smart Cars	Connected vehicle - self diagnosis, car-to-car communication etc.
Healthcare	Health Monitoring – tracking and communicating vital health parameters.

IoT is an interdisciplinary domain involving sensors, devices, network, power etc. Realizing the concept of IoT requires considerations such as the overall architecture, communication technologies, security and privacy aspects, etc. There is a strong focus from standardization bodies in making this happen. Organizations such as ITU-T [13], IETF [12] and ETSI [5] are driving activities for standards development and coordination for M2M / IoT.

The academic institutes have a lot of focus on IoT too. e.g. The Auto-ID Labs [2], which comprises of seven of the world's most renowned research universities, is leading global network of academic research laboratories in the field of networked RFID.

There is a strong global focus on IoT including those from private and public parties. Chip vendors are making smart chips and providing application-level connectivity frameworks [10]. Software vendors are developing software platforms [16] designed to build and run the applications of the connected world. Service providers [1] are investing in facilities to accelerate the development of new applications for M2M and IoT. There is a strong verticalized industry specific focus as well [11]. Hardware and software vendors are collaborating for developing IoT solutions [4].

Besides, regional organizations are also working to harness the promise of IoT. e.g. the IoT European Research Cluster (IERC) is trying to address the large potential for IoT-based capabilities in Europe and to coordinate the convergence of ongoing activities [6]. Governments have also realized the need to address M2M / IoT. e.g. The Government of India has actively started to pursue preparation of policies around M2M / IoT communications [9] and has setup a task force for addressing M2M in the country. In its 2014-15 budget, the Indian Government has announced a sum of Rs.7060 crore in the current fiscal for the project of developing "One Hundred Smart Cities" [17].

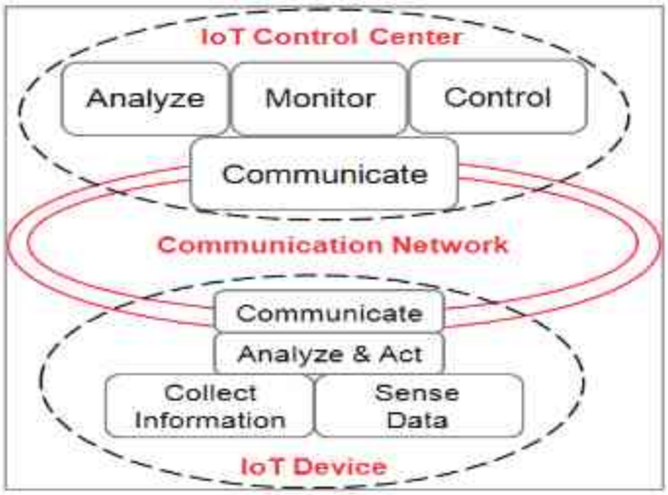
According to a analysis report [18] [3] there has been an broad interest in M2M solutions across 5 key M2M sectors including Automotive, Energy and utilities, Transport and Logistics, Manufacturing / Consumer electronics and Consumer goods / Retail. According to a leading M2M service provider who is serving around 7.8 million M2M connections globally [19], an increasing number of global businesses are incorporating M2M communications into their core operations, leading to greater productivity, enhanced customer service, lower energy use and decreased carbon dioxide emissions.

In summary, there is a strong drive towards IoT from standardization bodies, academia, device vendors and service providers. Service providers have identified IoT as a key driver for the enhancements of the communication network leading to efforts such as 4G & beyond and device to device communications. Overall, industry specific solutions, expanding communication networks, economics of scale of IoT enabled devices and viable business benefit propositions will lead to better adoption of IoT.

3. Key Aspects of IoT

Key elements of the IoT system are intelligent devices & the controlling entity. The figure below provides a logical representation of the IoT eco-system.

Figure 1: IoT Eco-system



Sensing & Collection of Information: The IoT devices should be able to collect or sense information based on their specific capability. e.g. a light bulb will sense the ambient light in the environment. Sensors could be of any kind - wearable, ingestible, implantable! e.g. a Smart watch or a wearable wireless accelerometer to measure daily exercise progress, an ingestible biomedical sensor that can be administered with pills or incorporated into medicines to measure vital signs for the patient, an implantable pressure sensor that can measure pressure etc.

Analysis and Act Upon the Information: The information collected by the object has to be analyzed and acted upon. A sensing and actuating device may detect or measure information related to the surrounding environment and convert it into digital electronic signals. It may also convert digital electronic signals from the information networks into operations. e.g. a plant sensor determines the moisture in the soil periodically and when it finds that the moisture level in the soil has dropped it decides to send a SMS to the controlling system. Similarly, devices should be capable of executing operations based on information received from the control systems. e.g. a water pump is instructed to start or stop water flow based on the need of water.

Communication of Information: The devices should have capability to communicate information over some communication network. Based on the device capability it could communicate through various mechanisms such as the cellular network, device to device communication technologies such as Bluetooth or Zigbee, or directly over the IP network.

Analysis, Monitoring, Control & Management: Backend systems should have the capability to configure the devices, monitor them and control them. These systems should also be able to receive information from the devices, analyze it, take appropriate action and generate management dashboards.

Realization of an IoT service requires a lot of considerations. Some of the key ones are listed below.

Device Capabilities: Devices should have the capability of sensing, actuation, data capture, data storage and data processing. The specific need of device capabilities will differ from application to application.

Device Addressability: It is required that devices be locatable or addressable. e.g. by using a unique IPv6 address or mobile number.

Device Identification: Devices need to be uniquely identifiable to be able to determine the characteristics of the device for controlling and information collection.

Accessibility: The devices should be accessible over some communication mechanism or through other devices.

Security: Security is a key IoT concern. It is important to maintain confidentiality, authenticity and integrity of the data that is being communicated.

Privacy: Devices and services are associated with users. Data collected by the devices may contain information concerning their owners or users. Thus, it is required that the IoT service provides privacy protection during data communication, storage and processing.

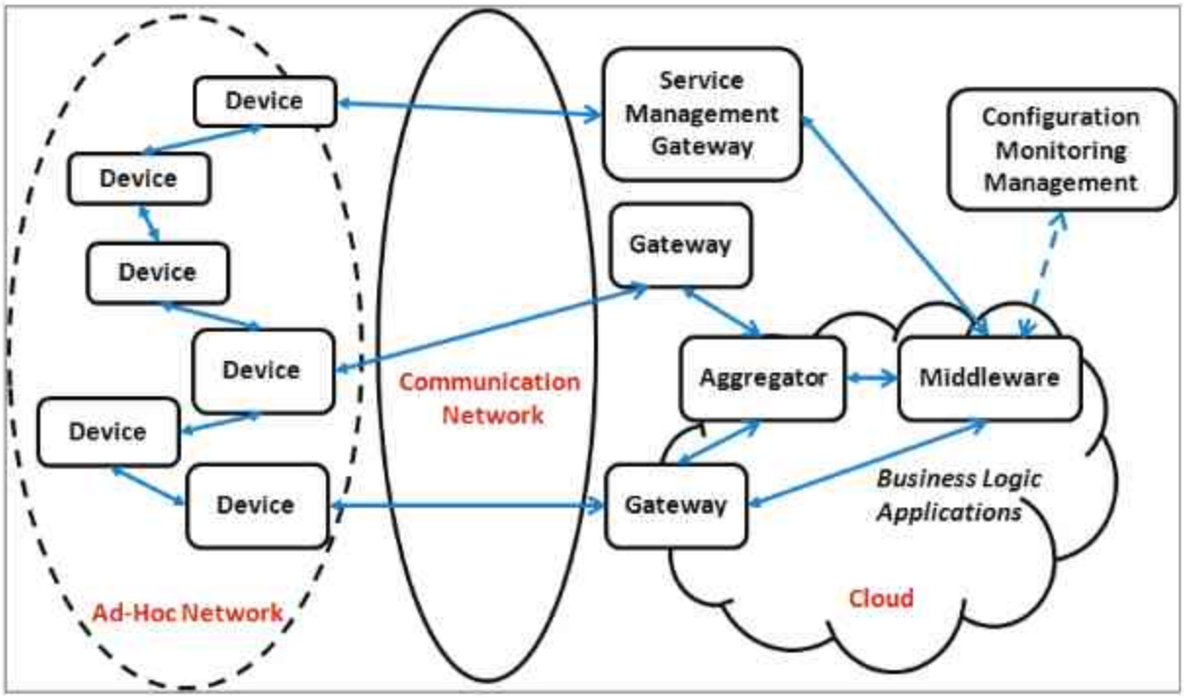
Policies: IoT applications are likely to generate a lot of traffic. It is important to define policies about data communication, alerts generation etc. and tune those based on the service requirements or traffic analysis.

Maintenance: Given that IoT services will result in a larger quantity of devices, it is going to be difficult to maintain those devices. Devices need to support some self diagnosis capabilities to alert the management system about its health.

4. IoT Architecture

The concept of IoT is still evolving and cannot be necessarily modeled in a uniform way. The below diagram provides a potential architectural model for implementation.

Figure 2: IoT Architecture



The devices communicate information to a Gateway that understands the communication protocol that the device uses. Due to existence of multiple communication mechanisms, there may be different types of gateways talking to the specific devices that understand the particular communication mechanism. Devices may communicate with other devices directly i.e. without using the communication network or through the communication network without a gateway as an intermediatory [14]. An aggregator may serve the function to provide a uniform view across multiple devices and gateways. The aggregator will have the capability to talk to multiple types of gateways and communicate in a uniform way to the Middleware which hosts the business logic of the specific service that is realized. The Middleware and its associated entities would have monitoring, management and control functions to overlook the IoT service. There may be other functions in the IoT eco-system based on the specific design of the IoT solution. e.g. for systems which depend on cellular communication, a separate service management function may exist which addresses the provisioning and activation of the Subscriber Identity Module (SIM). Some of the IoT eco-system components can be hosted in the Cloud environment.

5. An example of Manifestation of IoT

As an illustration of IoT, consider a scenario where a forest needs to be tracked for illegal tree felling to avoid deforestation. Tracking device can be camouflaged and made to blend in with the trunks of trees. It would be difficult to provide cellular or wired networks for these devices in the forest. However, device to device communication technology could be used for these devices. The devices could potential connect with other devices and form an ad-hoc network of connectivity. When lumber gangs try to harvest a tagged tree, the device associated with the tree can start sending notification messages through this ad-hoc network to the control center (middleware) and thus notify the tree harvesting attempt in real-time to the law enforcement agencies. Furthermore the location capability of the devices would help the officials to track the felled trees being transported, intercept and arrest thieves in the act of selling wood. The Law enforcement agencies in Brazil implemented a similar solution in the rain forest of Brazil to track illegal tree felling [15].

6. Findings & Deliberations

Success of IoT depends on contribution from multiple entities of the IoT eco-system. Industry specific standards (e.g. health, manufacturing etc.) will have to evolve and reach a critical stage of wide adoption. Standardization bodies will play a key role in evolving such standards. One key element of the IoT systems is the IoT devices. Device manufacturers will have to ensure that the manufactured devices comply with international specifications and are interoperable with other elements in the IoT system. IoT offers tremendous potential for industries to benefit from, in terms of operational efficiencies, enhancing customer experience and delivering new services. e.g. the Railroad / Railways industry could use IoT sensors to keep track of the rail tracks to do preventive maintenance and avoid accidents due to issues with the rail tracks. An exporter of perishable items will be able to track the environmental conditions in which the goods are being transported, the state of the goods itself and the time to deliver, thus ensuring quality of service. The telecom service providers can play a pivotal role for such implementations. Communications between the devices and the backbone systems is a key aspect of IoT. Telcos could offer M2M based connectivity services required. They can further evolve as a M2M service providers to offer various M2M services to the industry and government organizations. e.g. Telecom service provider Vodafone provides M2M services and focused on solutions for major verticals like Utilities, Automotive, Manufacturing, Transportation & Logistics, and Financial Services sectors. An example of the verticalized service offering is its strategic partnership with Mahindra & Mahindra for providing M2M connectivity for 'e2o' (the Mahindra 'connected' car), to have telematics based features that enable 'anytime, anywhere connectivity' between consumer and their cars. Device conformance and quality test standards need to be evolved. Government agencies need to formulate national policies around M2M / IoT communications to further IoT. In addition, the governments should themselves adopt IoT and reap its benefits.

The IoT eco-systems need to be made plug and play to enable smooth scalability. e.g. when a device is deployed, the device should be able to detect communication networks available to it and other devices to communicate with. IoT services need to be relatively easy to use, which means that the ability to configure, control and monitor the IoT eco-system should be reasonably well defined. The system should be able to track the happenings in the IoT environment. e.g. logging interactions between devices and systems to be able to analyze as to who initiated a certain action and what was the trigger for that initiation. The devices need to have self diagnosis capabilities to be able to generate alerts upon certain conditions. e.g. low battery. Similarly, the system should be able to track device functioning – e.g. device not reachable. Mechanisms such as - password change alert, multiple accesses through a single log-in, alert when password not changed for a minimum duration – needs to be implemented to ensure security.

As the adoption of IoT picks up, it would lead to considerable increase in informational data. This data needs to be analyzed for generating actionable intelligence. e.g. data generated from monitoring of an industrial equipment may provide early diagnosis of potential failure of the equipment and this can be used to do preventive maintenance. However, the huge volume of data itself would require considerations for storage and Big Data analysis techniques for processing. Given the increase in consumption of video content by consumers, the cellular, and wireline networks of today are already falling short of supporting the bandwidth requirements. While the communication networks will continue to evolve, would they be sufficient to handle the additional IoT traffic data requirement is a question of considerable interest. Device to Device communication (D2D) could be a driver to offload backbone data traffic. D2D can be used for proximity-based IoT services and is already supported by several standards such as ZigBee, Bluetooth, NFC and WiFi-Direct. Currently, the 3GPP standardization body is working to extend this feature to the LTE networks.

However, there are still many challenges in the adoption of IoT. Cost of implementing an IoT solution is still a major concern. The overall solution cost makes a difficult business case. Enterprise's still don't see a major incentive in implementing IoT, as the perceived return on investment is not attractive compared to the state of current operations. Governments are pushing for a risk-reward model and suggesting a private public partnership model for rolling out IoT solution instead of upfront investments. For the end to end service providers this makes it very difficult to price their solution. Besides, there are societal implications in adopting IoT as well. Potential loss of employment is a concern in some market segments. Adoption of IoT is being enforced by authorities, but unless it is accepted in spirit it won't be effective. E.g. some local authorities have made it mandatory to implement school bus tracking system. Implementing only GPS tracking of the school bus will only help to certain extent in knowing the location of the bus at a given point in time, but unless the solution is used effectively to track other aspects such as bus halt

time, activities in the bus through video recording etc, its effectiveness will not be fully realized.

7. Conclusion/Implications

While the realization of IoT services is a reality today, the adoption of it depends upon many factors. e.g. How do you make the system simple for the consumer to use? As organizations and individuals put their trust in IoT, how do you ensure that the system is not tampered with and affects business? How does the IoT system scale easily and yet remain manageable? How does one buy off the shelf IoT devices and get them to work with their IoT service? Addressing such needs requires considerable effort on part of the industry, academia and standardization bodies to work in close coordination.

Analysts predict that 'The Internet of Things' is evolving from a niche area into a mainstream activity, especially in the next three years and enterprises should seriously investigate and initiate pilot projects to position themselves to exploit the coming opportunities [7, 8]. Advances in communication technologies, electronic miniaturization, affordability of devices, communication & services and above all the benefits of connected world solutions is providing impetus for furthering of M2M / IoT. Real world applications of M2M/ IoT are in use today. The world has already started to witness commercialization of M2M / IoT solutions such as smart metering, energy monitoring, e-Health, intelligent transportation systems etc.

Much of IoT adoption today focuses on productivity and effciency gains. 'IoT' is being used as a suppliment for business-as-usual. However, the benfefits of IoT can be truly reaped, if it is treated to be a transformational and disruptive technology. It can be safely predicted that the drive towards developing intelligent IoT solutions and its adoption will only continue.

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Business Case for a FTTX Provider in a Smart City

Senthil Ganesh Murugan*, Abhijit Nambiar**

**Ericsson Business Consultant, Lead Consultant, Bengaluru, Karnataka, India.*
E-mail: Senthil.ganesh.murugan@ericsson.com

***Ericsson Business Consultant, Consultant, Bengaluru, Karnataka, India. Email: abhijit@ericsson.com*

ABSTRACT

This paper proposes a futuristic business model, which enables the fibre data and telecom providers to partner with smart city administrators, to serve a concentrated market with soaring bandwidth needs. This model will establish a symbiotic situation for both the partners. The paper talks about how fibre broadband serves as an answer to the ever increasing digital appetite of the modern society. Various capital and operational costs associated with a FTTX roll out project for a smart city are discussed in detail, to give the reader a realistic picture. The paper also talks about the segmentation of the market, products and services. In addition to these, the various sources of revenue and a financial analysis, comparing the investment against the returns, over a period of ten years, are discussed in detail.

Keywords: PPP Model, Fibre Networks, Cost Analysis, Customer Segments, Passive and Active Networks

1. INCREASED BANDWIDTH CONSUMPTION AND KEY TRENDS

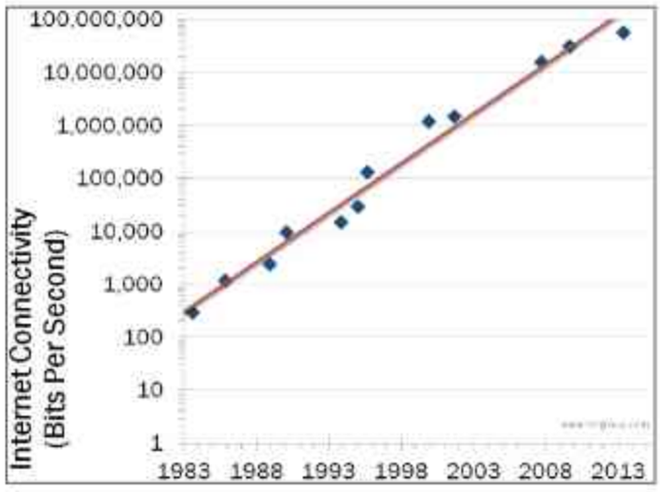
The current society is seeing an ever increase in its"digital appetite". The bandwidth is consumed in various ways such as photos sharing, HD movie streaming and video calling.

There's no definite answer to the question "How much bandwidth is enough?"Nielsen's law of internet shows that a high end user's connection speed increases by 50% per year.(Nielsen's law of internet bandwidth)

Considering these trends in mind, the Over the Top (OTT) service providers too have tweaked their business models to build products revolving on high bandwidths. DVD rental firms such as Amazon and Netflix and VoIP players such as Skype HD services are all providing customer delight products, which run on a minimum of 1Mbps connection for superior experience.

This type of "digital appetite" is basically seen from urban population who are opting for these OTT services and hence, the higher bandwidth needs. Also, the population living in the urban areas will go up to 70% by 2050. The future will see an intersection of these two trends of urbanization and rapid uptake of broadband, thereby giving rise to the concept of smart or digital cities. The smart cities are the ones where everything shall be connected, combined with digital governance, all- enabled by high speed broadband. This opens up a huge market to the broadband service providers with lucrative deals.

Figure 1: Nielsen's Law of Internet Bandwidth.



Source:Nielsen Norman Group

Doubling broadband speeds for an economy can add 0.3 percent to GDP growth. In BIC (Brazil, India and China) countries, introducing a 0.5 Mbps broadband connection increases household income by USD 800 per year. Also, upgrading from 0.5 to 4 Mbps increases income by USD 46 per month.(Socioeconomic effects of broadband speed, Ericsson, 2013)

An FTTH network can save up to 1.5% of costs in the four main economic sectors: Electricity, Transportation, Education, and Health – in addition to the direct benefits in telecommunications. FTTH has a positive impact on the environment too. 1 million users connected is equivalent to at least 1 million tons of CO2 saved.(The socio-economic impact of Fibre to the Home, FTTH Council Europe, 2011)

2. FTTX Service Business Model

This steady increase in bandwidth demands from customers has forced the legacy copper networks to become obsolete. This is where FTTx (Fibre to the Subscriber) comes into the picture. The fibre network is establishing itself as the foundation for our digital needs, bringing in prosperity and whole host of business, social and entertainment opportunities.

There are multiple models to build FTTx. The following section discusses the pros and cons of each of the models. The first one is the "Ownership" model, where the Government owns the entire infrastructure, including the active and passive. Also, the Government takes ownership and deploys both the active and passive infrastructure. This model has the highest level of involvement from the Government. The advantage of this model is that the Government has complete control over the project and there will be no integration issues. The disadvantage will be that the Government will have to take care of the high levels of investments needed over the entire course of the project. The Government has to take care of all of the operational issues during the project. Also, the changes in Government policies will have direct impact on the progressing projects.

The next one is the "Supportive" model, where the Government does not interfere directly in the ownership and deployment of the infrastructure. Here, the Government provides incentives to the companies for deploying the infrastructure. In this model, the Private sector completely owns, builds and operates the infrastructure, with aid from the Government. This model might create problems due to the lack of ownership and in the long run there can be many issues such as Rights to the land of operation, the ownership of the passive infrastructure over a longer period, the integration issues and ways of operation between the Government and companies.

An alternate model is the "Public Private Partnership" model (PPP), which is discussed in the next section.

3. Public Private Partnership (PPP) Model

PPP model is the one in which the Government owns the infrastructure. The private sector operator builds and deploys the infrastructure. Also, the operator has the responsibility of managing the wholesale services. The operator is selected by a competitive process, such as tender. This model entrusts accountability and responsibility on all of the involved parties. In this mode, while the ownership lies with the Government, the expertise of the private sector is leveraged. The operator brings in the technological innovations and financial aspects, appropriately.The Government funding acts as the catalyst to get the best telecom operators to come forward for the fibre network deployment projects.

This model helps to get the right scope, accelerated time lines, diversified risk and efficient execution, thereby best suited for large infrastructure projects.The PPP model is successfully implemented in various parts of the world. The first case is Region Auvergne, where France Telecom has designed, operated and commercialized the project to provide broadband services. The contract is for a period of 10 years. The budgeted cost is EUR 38.5 million, which is provided by the Region Auvergne. The passive and active network layers are provided by France Telecom as a wholesale service provider. The retail service provisioning is handled by various players in the competitive open market. Region Auvergne will pay for the CAPEX, OPEX and financial costs during the ten year tenure.

The next case is that of Metropolitan Networks Project ("MAN") in Ireland. The individual MANs are managed by e|net for a period of 15 years. The project cost of EUR 170 million is funded by the Government authorities and the infrastructure is owned by the State. e|net sells the active and passive services to the service providers in wholesale.

The third case is that of the Shetland SHEFA 2 Interconnect Project ("Interconnect Project"), which forms part of Shetland Island Council's ("SIC") strategy to encourage a rapid deployment of broadband networks in Shetland. The cost of the project is EUR 1.7 million, which is funded by the SIC. In this case, the wholesale active and passive network services are provided by an SPV, formed between the SIC and an established telecom

Figure 2: Role of a Fibre Network Provider in a Smart City in PPP Model

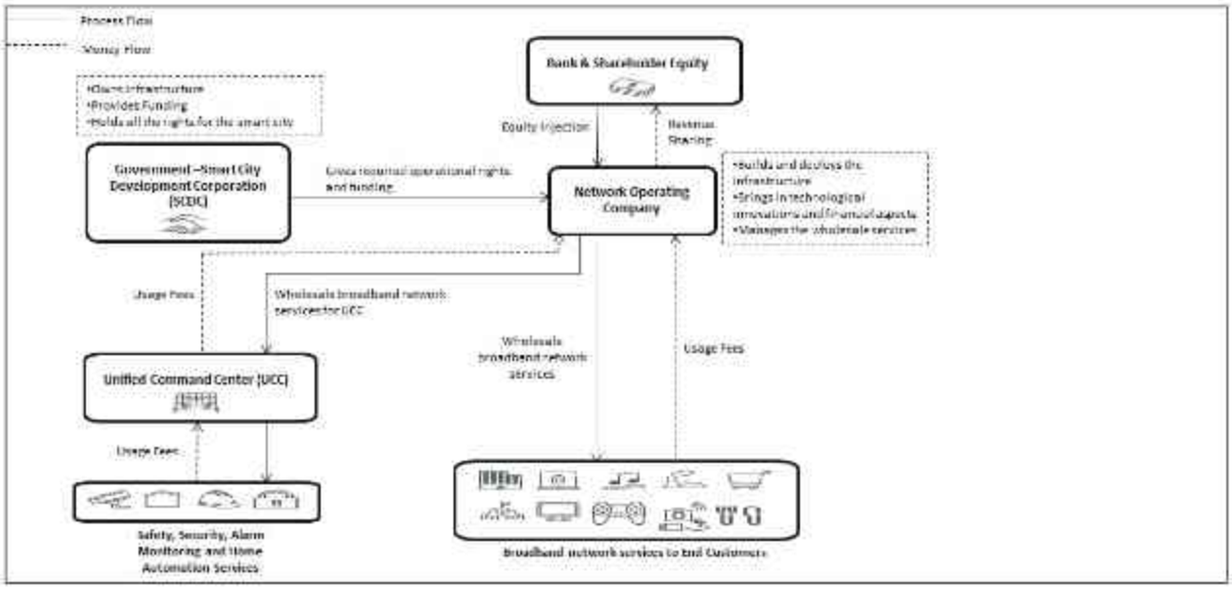


Figure 3: Network Service Layers in a Smart City.

Source: FTTH Business Guide

operator. The project runs on a rolling three year contract. (Delivering next generation access through PPP, EPEC, 2012)

Figure 2 describes how a Fibre network provider can get into the value chain of smart city, effectively. In a typical smart city plan, a smart city development corporation (SCDC) will be setup, in a Public Private Partnership. This SCDC will own all the rights for the land in which the smart city will be developed. Also, in a true sense, the SCDC is the owner of the entire smart city.

The SCDC appoints a fibre network provider to build and operate the fibre network needed for the broadband requirements of the smart city. Also, the SCDC gives all the necessary operational rights for the network provider to commission and operate the fibre network. The Build-Operate-Transfer (BOT) model can be best suited in this scenario. Here, the network provider builds the fibre network initially and then the provider operates the entire network in order to provide both wholesale and retail services.To avoid any legal hassles associated with monopoly and at the same time maintain a profit making unit, it's essential the network operator should operate both wholesale and retail businesses. While the wholesale business is completely owned by the operator, the retail business will see multiple operators offering services after leasing/buying network from the main network provider. This model has been implemented successfully in the City of Joburg – Smart City. The operator B-Wired

is a special purpose vehicle which is a joint venture between Johannesburg municipality, Ericsson and a local operator. B-Wired provides exclusive retail services to the customers inside the smart city and apart from this also leases the fibre network to other operators for them to provide retail services within the smart city, to avoid legal consequences of a monopolized market.(Bwired - Product Portfolio)

The typical contract period for the network provider could be 10 years, wherein the firm can plan for the necessary investments and devise plans to reap the revenues, appropriately. This will be a reasonable time frame for a network provider to break even and become profitable.

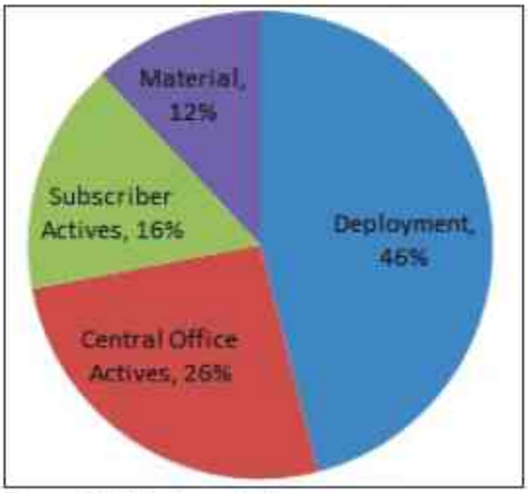
The Unified Command Centre (UCC) is a separate stream, which incurs significant investments and has the potential for huge returns. The network provider provides the necessary broadband network services to enable the high bandwidth requirements of the UCC, such as video surveillance, alarm monitoring, intrusion monitoring and automation services.

Network service layers in a smart city are represented in the Figure 3. (Network service layers in a smart city, FTTH Council)

4. Cost Analysis

Figure 4 shows the typical CAPEX apportionment for the fibre network provisioning in a smart city, corresponding to the layers mentioned in figure 3. (CAPEX apportionment, FTTH Council)

Figure 4: CAPEX apportionment.



Source: FTTH Business Guide

The following sections discuss the cost distribution:

4.1. Passive Network Deployment Costs

The passive network deployment costs and the passive network material contribute to 58% of the CAPEX. This is a huge capital expenditure to be made and the point to note is that almost half of this passive network deployment cost has to be invested in the first three years of the business. The civil work costs comprise of costs for the activities such as excavate, fill and manhole construction. These deployment costs have to be considered for rolling out the following three types of passive fibre networks: Base Fibre Ring, Distribution & Feeder Network and Vertical Built. Base Fibre ring is the fibre ring that is built throughout the circumference of the city. This Fibre ring has to be laid first, sequentially. Distribution & Feeder Network Built is the fibre that connects the Base Fibre with that of the ONTs in the Building blocks. Vertical Built is the internal connectivity that is done within the floors of the building premises.

4.2. Central Office Active Network Equipment Costs

The central office active network components are 26% of the CAPEX and are borne by the government entity. Passive optical network (PON) and Point to Point (P2P) are the two widely used architectures in fibre network deployment. P2P fibre provides symmetrical bandwidth and dedicates a single fibre for each end user. Gigabit Passive Optical Network (GPON) is a Point-to-multipoint (P2MP) technology where a single fibre is shared by several users via an optical splitter. P2P, with their dedicated lines, can suit the commercial customers, while GPON can suffice the needs of the residential customer.

GPONor P2P Central Office active network Equipments and Internet Protocol Television Head end / Video on Demand (IPTV HE/VOD) Servers have to be installed.

4.3. Subscriber Active Network Equipment Costs

Nowadays, integrated Customer Premises Equipments (CPEs) are available which perform the functions of home gateways, routers and optical converters. Appropriate CPEs have to be installed for varied customer premises such as: Single Family Units (SFU), Multi-Dwelling Units (MDUs) and Enterprises. Additionally, the Set Top Boxes (STB) and Ethernet switches have to be installed appropriately at the customer premises.

4.4. OPEX Costs

The operating expenses for a fibre network provider in a smart city consists of employee salaries, administrative expenses, customer acquisition costs, content acquisition costs, marketing and sales costs, backhaul costs, network operation and maintenance costs, IT maintenance support costs and rights of way costs.

The OPEX is lesser in the initial years and grows gradually, as the number of subscribers within the smart city increases.

5. Customer Segments in a Smart City

There are various segments of customer that a fibre service operator can come across in a smart city segmented according to the nature of the service or the bandwidth needed for each of them. Some of the broadly defined segments are:

Private Customers

- Residential
- Businesses
- Industry
- Shopping/Retail
- Recreation (Hotels & Entertainment)
- Private Clinics
- Home Automation & Security Services

Public Customers

- Public Health Services
- Public Emergency Services
- Utilities
- Public Governance Services

Wholesale Business

5.1. Private Sector Customers

In a Smart City environment where everything is connected, people, knowledge, devices and information are networked for the progress of business and society. These private customers are the major contributors to the revenue in this business model and they comprise of sub segments such as:

5.1.1. Residential

A typical residential package could be of two variants – Premium and Basic in our case. The service will consist of a High Speed Internet Access (HSIA) whose speed might range from 10 Mbps to 50 Mbps, with or without a data cap. Apart from this the resident will have access to Video on Demand (VoD) services and multiplayer gaming. If the operator owns the voice and the TV network as well, then the Triple play services can be provided.

There could be two methods an operator can charge their customers: subscription and pay per use.The subscription prices are charged at a fixed rate, monthly, while the pay per use customer would be paying as per the number of Mbs of data used. The price erosion factor has to considered, once the economies of scale are achieved.

5.1.2. Businesses and Industries

The concept of a networked society is usually based on the coexistence of varied entities such as work, recreation, retail and health. Also smart city hosts a number of business entities, who need bandwidth intensive enterprise data services. There's also a market of the small and medium enterprises (SME's), who need the enterprise data services at a lower scale.

The prime product in the service bouquet is the high speed internet access (HSIA), with speeds ranging from 25 Mbps to 100 Mbps. The basic business pack targets the SME's and the premium business pack satisfies the needs of large enterprises. Apart from these products, the enterprises would need a range of data products such as VPN, Hosting services, Business communication services, Teleconferencing services and Hosted data centres.

Also, the smart city will have manufacturing and other heavy machinery industries that would need products at a more local level. The VPN would be a local Ethernet based one and the hosting services too would be specific.

5.1.3. Shopping/Retail

The retail spaces will have their own fibre data needs for the retail centre's security, marketing and promotions. The service provider can provide access to each of the shopping units in the mall and create a local network for the transfer of information. Since, the complexity of services is less and the number of shopping units will be more, it will be a volume based business for operator.

5.1.4. Recreation (Hotels and Entertainment)

The recreation units will need services which satisfies their customers, who in turn, want basic communication services and internet services in the form of wi-fi. Also the operator can give a community antenna service for the TV content and charge the hotel a onetime fee or a subscription fee.

5.1.5. Private Clinics

The private clinics would need a reliable data connection for the advanced services they would offer to the inmates of the smart city. Services such as remote monitoring, health care management services and e-health services will need a constant bandwidth for a certain period of time without any interruption.

5.1.6. Home Automation & Security Services

The Home Automation and Security services are primarily provided by the command centre. The command centre is hugely dependent on the fibre service provider, as the services involve constant interaction between the installed devices and the centre. This uninterrupted communication is the backbone of the command centre services. The data service provider can charge a monthly or a onetime fee to the command centre for the enablement of automation and security services. The various services which come under this bouquet are: smoke detection and intruder alarms, utilities billing and metering, lighting control, video monitoring and access control systems.

5.2. Public Sector Customers

The advantages of high speed broadband need not only be reaped by the private sector, but also, it can help governments and municipalities to provide the residents of the smart city a host of intelligent governance applications. The broadband enables the authorities to effectively administer the high end services, in domains such as education, health care, traffic management and pollution control.

The services in public domain are divided into a few broad categories in this paper:

5.2.1. Public Health

A sturdy and reliable broadband connection enables advanced applications to facilitate better delivery of health services to the smart city residents. The host of services include remote monitoring, health care management, remote surgery and home care for elderly. The digital health and remote monitoring solutions not only support a hale and hearty lifestyle, but also cut down on travel and other documentation, which makes the service faster and effective. The digital health care management forms the core of the offering, by facilitating electronic reporting and booking, updating patient records, digitizing prescriptions and referrals and eliminating the need for printouts when sent to pharmacies, hospitals and laboratories.

The pricing of the service largely depends on various factors such as the per capita health expenditure, the out of pocket expenditure and the ratio of private to public expenditure on health. Each country can accordingly price these services based on the mentioned factors.

5.2.2. Emergency Services

A city faces various challenges in terms of the emergency response because of the various layers of administration involved and there's no dedicated channel to effectively relay all the information. Effective handling of emergency events with optimized distribution of resources and co-ordination between various teams can be enabled only by a centralised monitoring system. Enhanced bandwidth provided by fibre services and highly responsive systems enable the unified command centre to deliver services such as real time emergency response, location optimization, security monitoring and accident prevention. The centralised reception reports about various emergencies, events and alarms which are aided by real time video transfers to the centre and a responsive action is taken by the various teams involved.

The service involves huge infrastructure and "always on" broadband connection to facilitate it. A part of the cost could be charged from the smart city residents and since the services are about safety, the customers will be willingly parting with the amount.

5.2.3. Public Governance Services

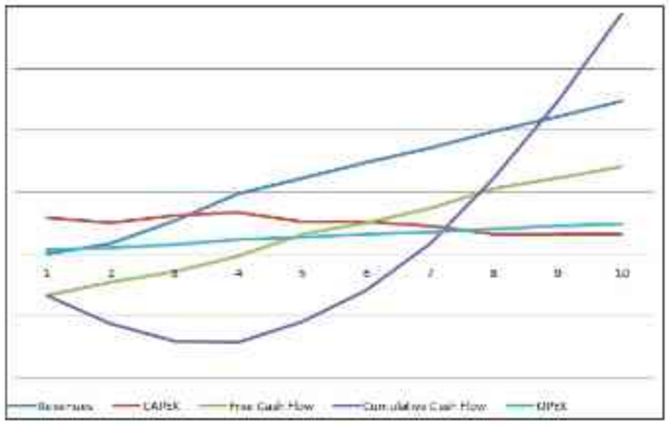
For effective governance, understanding public concerns ahead of time and mitigating them is mandatory. A command centre which bases its platform on advanced social analytics will help the government to provide effective governance. Some of the services which can be provided using this platform would be traffic management, toll road pricing, street light management, road accident monitoring and handling services. The inter-departmental

collaboration is the key here, in order to make the city safer.These services are enabled by the command centre platform and would need some applications like social media analytics and other communication tools.

5.3. Wholesale Customers

The wholesale arm of the said operator shall be responsible for leasing or sharing of networks with the other operators vying for a pie in the retail market. Since, the network infrastructure is owned by the government, it shall too get a cut out of the whole deal struck between the two operators. With pricing stability, controlled market conditions and high bandwidth consumption the wholesale arm will be a significant contributor in the revenues of the operator. The operator can lease its networks on a fixed pay kind of mode or it could charge on the basis of usage to the retail operator. The core business of the operator shall still be the retail market; the level of involvement in the wholesale business will be relatively lower for the main operator. This consolidation eventually will help create a mature market with the players solely concentrating on customer satisfaction and better services.

Figure 5: Trend of Investments and Returns



6. Financial Analysis – Investments and Returns

Figure 5 shows the trend of the investments and returns in a typical smart city model. The CAPEX is initially higher and gradually reduces, over the ten year period. The revenue increases as more and more customers take up the services of the network service provider. Proportionately, the OPEX also increases, as the subscribers increase. At year 4, the revenue clearly surpasses the CAPEX and OPEX and hence, the free cash flow (FCF) turns positive. Eventually, the cumulative cash flow (CCF) turns positive after the 6th year.

Though the FCF is positive after 4th year, the CCF takes 6 years to turn positive, due to the huge upfront investments.

7. Conclusion

As discussed in this paper, in the current scenario of cut throat competition and price wars between the broadband service providers, there's a need for these entities to keep looking for new opportunities and markets. With the increased adaptation of the concept of smart cities, these service providers can play a role much more than just that of a "dumb pipe", in the whole value chain. These providers with superior service and foresight can lead the transformation and be the change agent in the whole ecosystem. By establishing a Public Private Partnership(PPP) with the governing entity of a smart city, the broadband players enjoy not only the advantages of a dedicated high usage market with very less churn, but also avoid pooling in huge money for the project in terms of CAPEX. The PPP business model has been compared to various other existing models with their advantages and disadvantages drawn out clearly.

Financially, the business model is quantified with the estimates for the CAPEX, OPEX and the sources of revenue over a period of ten years. This analysis clearly suggests that by the end of 4th year the broadband provider sees a positive free cash flow and the cumulative cash flow turns positive after 6th year, giving the entity a good 4 years to reap the benefits. This equation will have a considerable impact on the financials of the network provider, from a small and concentrated market.

Hence, providing fibre based connectivity services to the smart city is a profitable value proposition for network providers. These opportunities will open up new revenue streams and it's time for the traditional network providers to take a look at the smart cities and grow their businesses profitably.

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Comparative Analysis of Regulatory Frameworks: A Study of Three Sector Regulators in India

Abhishek Dhiman*, Vishal Parimo*, Giri Hallur**

**MBA, IInd Year student, Symbiosis International University, Symbiosis Institute of Telecom Management, Pune, Maharashtra, India*

***Assistant Professor, Symbiosis International University, Symbiosis Institute of Telecom Management, Pune, Maharashtra, India. E-mail: girihallur@sitm.ac.in*

ABSTRACT

This paper aims to study and analyze the institutional framework of three Indian sector regulators Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), and Telecom Regulatory Authority of India (TRAI).The study highlights the differences and commonalities in regulatory frameworks for different sector regulators in India. It broadly addresses the two important attributes of regulatory systems (1) Institutional Framework and (2) Extent of autonomy given to the Regulator. The research methodology adopted is qualitative comparative analysis (QCA). Among the three regulators, it is found that the TRAI is relatively less empowered in terms of reporting structure, tenure of the Chairman, funding mechanism and capacity building. Participation of DoT in TRAI consultation process, publication of minutes of meeting and the need for institutions for capacity building in telecom regulation come out as the key recommendations for improving the policy & regulation process in Indian Telecom.

Keywords: Infrastructure Regulation, Legislation, Policy, Transparency

1. OBJECTIVES OF THE PAPER

This paper presents the comparative analysis of three sector regulators in India namely, the RBI, SEBI & TRAI on two important attributes of regulatory systems (1) Institutional Framework and (2) Extent of autonomy given to the Regulator. The attempt is to understand the functioning of first two regulatory agencies mentioned abovein order to bring outsimilarities and diversity in comparison with Telecom Regulatory Authority of India (TRAI) in their functioning, structure and authority and come up with recommendations that may be incorporated by TRAI to make it an effective telecom regulator.

2. INTRODUCTION

Over the years telecom industry in India has witnessed numerous irregularities in policy formation & implementation. Industry leaders and investors have expressed their opinion that the telecom sector is no longer an attractive option for investment on account of policy uncertainty. In a survey conducted (Samarajiva et.al, 2007) for five Asian countries by Lirneasia on Telecom Regulatory Environment (TRE) ranks India below other Asian countries like Pakistan, Sri Lanka in parameters like independence, transparency, consistency, pro- competitiveness, however, it scored highest marks for tariff regulation, wherein the TRAI has authoritative powers.

India has a number of sector regulatory bodies which regulate the specific sectors with an aim to safeguard the interests of various stakeholders, monitor the adoption of standards and safety, or to oversee fair use of public goods and regulate commerce. Every regulator has been designed to cater to its specific sector and has its own methods & processes. However, literature on regulatory systems and in particular a World Bank report present certain attributes that regulator (irrespective of the sector) should possess so that it is able to perform its regulatory function transparently and efficiently. So, aim of our research is to compare the three Indian sector regulators using the regulator's parameters as mentioned in World Bank report (Jon Stern et.al, 2007) as a benchmark. We have focused on regulators from liberalized sectors in India and hence we have selected Reserve Bank of India (RBI)- regulator for banking sector in India, the Securities

and Exchange Board of India (SEBI) that regulates the securities marketand Telecom Regulatory Authority of India (TRAI) that regulates the telecom industry. Our objective is to understand the working of first two regulatory agencies mentioned to ascertain as to how similar or different they are from Telecom Regulatory Authority of India (TRAI) in their functioning, structure and authority and come up with recommendations that may be incorporated by TRAI to make it an effective telecom regulator.

3. Background & Need for this Research

The regulatory framework can be said to be divided into two parts: structures and process. Structure includes the distribution of regulatory tasks to different levels of the government, the objectives, scope and power given to each of these agencies and the procedures for choosing the regulatory agents.

With reference to the initial design of the regulatory system, its structure is more important than regulatory process. As has been seen in some countries such as Brazil (Prado, 2008) that the different sector regulators have different levels of autonomy and authority, although their Act of establishment have been ratified by the Parliament of the country. Secondly, at the time of establishment of the sector regulator, the minister & officials involved play a major role extent of autonomy given to the regulators. Thirdly, sector regulators have certain good practices that have yielded results for them, by doing a comparative research; these good practices can be studied and adopted by other sector regulators.

Hence, there is a need to undertake a comparative study of sector regulators in India. Moreover, review of published research shows that there is no cross- sector regulatory comparative study.

3.1. Need for Qualitative Research

Most of the research involving multiple countries and their regulatory environment has been quantitative in nature.The methodology for such research is based on generalizing the regulatory environment in a large sample of countries on the basis of certain common parameters. However, every regulator differs from the other in terms of commitment to regulations, extent of autonomy and availability of competent human resources etc. And hence for deeper understanding of the regulatory environment of a specific sector in presence of certain sector-specific conditions qualitative research method is used. Qualitative research methods (Ragin, 1994) help to bring forth the similarity as well as the diversity in the regulatory set-up of the various sectors. So, the researchers have used Qualitative Comparative Analysis as their research methodology.

3.2. Selection of Variables for Comparative Analysis

The World Bank Handbook(Jon Stern et. al, 2007) has highlighted certain key factors of an Infrastructure Regulatory Systems such as Independence ,relationship between the regulator and policymaker (s), Autonomy given to the regulator, regulatory, transparency of decision-making by the regulator, predictability of regulatory decision-making, organizational structure and resources available to the regulator.

The authors have also selected the variables on the basisof main institutional characteristics as stated by Levy and Spiller (Levy & Spiller,1994) in their 1997 paper in which they compare the institutional characteristics of four South American countries and the United Kingdom.

Deriving from the above mentioned papers and the fact that the aim of the authors is to study the other regulatory systems in India, the selection of the key variables was done.

The variables have been divided into three categories:

(1) Institutional framework
   (a) Regulatory entities involved in the decision making.
   (b) Scope and authority of the regulator,
   (c) Role duplication among the regulatory entities.
   (d) Extent of involvement of the Government/ Ministry.
   (e) Ombudsman/ ConsumerAppellate .

(2) Policy & Regulation formulation
   (a) Contribution of concerned stakeholders
   (b) Transparency and accountability in process of regulation/ policy formulation
   (c) Extent of Adoption of Self-Regulation

(3) Autonomy given to the regulator

(a) Financial Autonomy

(b) Process of Recruitment of top officials of the Regulator.

(c) Autonomy for recruitment.

(d) Representation of stakeholders in the Regulator's officials.

The authors have compared the three sector regulators namely, IRDA, RBI & TRAI on the basis of the above-mentioned parameters.

3.3. Selection of Sector Regulators

The attempt of the researchers was to study the sectors regulators of sectors in in India that have been privatized and liberalized. So, the following sector regulators were selected. The researchers have studied five sectors regulators; however, they have presented the findings for only three regulators in this paper.

RBI: the Reserve Bank of India (RBI) was established in 1935 in accordance with the provisions of the Reserve Bank of India Act, 1934. RBI regulates the banking and financial sector and is the oldest sector regulator in India

SEBI: the Securities and Exchange Board of India (SEBI) established in 1992 is the national regulatory body for Securities Market.

TRAI: Telecom Regulatory Authority of India (TRAI) has been established in India in 1997. It regulates the telecom, IT and Broadcasting sectors in India.

4. Discussion of the Findings

4.1. Regulatory Framework

1. Clear role definition between the policy making body and policy implementation body is one of the most important characteristics which makes a regulator effective, sinceas it can concentrate on the implementation of the policies. The two regulators RBI and SEBI have exhibited this particular characteristic. The policy formulation role in case of all the studied regulators is performed by the sector ministry including the telecom ministry. But, in case of TRAI, even the regulatory role of TRAI is not clear as it is being shared with DoT and Telecom Commission.
2. As recommended by International agencies like World Bank, all the three regulators have been established by an Act passed in Parliament, this is said to give the regulator credibility in the eyes of the investors.
3. The RBI and SEBI have been empowered to undertake licensing as well as policy implementation. But, the TRAI has the authority to implement regulations in few areas like Interconnection, Quality of Service & Tariff fixation. In other areas like Spectrum auctions, technology adoption the Department of Telecom and Telecom Commission have been empowered to administer. And Telecom Licensing has been totally kept out of the purview of the TRAI. This also means that TRAI is not the sole authority for policy & regulations implementation in the telecom sector.

4.2. Process of Policy Formation

1. RBI and SEBI represent an inclusive consultation process involving active participation of all the stakeholders. In case of TRAI, the DoT does not participate in the stakeholder consultation process.
2. RBI and SEBI receive their funding from two sources (1) part of the fees from sector companies (2) funding from the Government. Moreover, the funding from the Government for all the regulators comes from the Consolidated Fund (the disbursement from which is done without the active control of the Government in power). The arrangement of industry participants contributing to the regulator fund is totally absent in case of TRAI which is solely funded by the Department of Telecom with the funds being released from Consolidated Fund of India(CFI)
3. The RBI, SEBI & TRAI chairmen are all tenured only for 3 years. This is a commonality observed in all sector regulators. Longer tenure is associated with the institution building of the regulator.
4. All the sector regulators share a commonality in terms of the profile of Chairmen and board members. All three have/ had Chairmen as former IAS or Officials of State Owned Enterprises (SOEs). This suggests the existence of ministerial-bureaucratic–makingmodel. The UPA government has,

COMPARATIVE ANALYSIS

Parameter	*Reserve Bank of India (RBI)*	*Securities and Exchange Board of India (SEBI)*	*Telecom Regulatory Authority of India (TRAI).*
Act of Establishment	RBI Act 1934 & amendment in 1953	SEBI Act 1992 & amendment in 2002	TRAI ACT, 1997 & amendment in 2000
Regulatory entities (apart from the regulator)involved in the decision making.	None	Ministry of Finance	Ministry of Telecom & IT, Ministry of I & B, Dept. of Telecom(DoT), Telecom Commission.
Division of the authority and scope of the regulator,	Bank of Issue (Banker to Government), Controller of Credit and Interest Rates, Custodian of Foreign Reserves (supervisory Functions), Licensing, Initiating new regulations(RBI website)	Regulation and Licensing.	Policy Formulation is done by DoT and Telecom Commission. Policy implementation in certain cases is done by TRAI and the rest of the cases it is done by DoT. Licensing is entirely done by DoT.
Role Duplication	No(Sole Regulator)	No(Sole regulator)	Yes, The recommendations of the TRAI are scrutinized by both the Telecom Commission as well as the DoT and in case of spectrum pricing the Empowered Group of Ministers(EGoM).
Role of the Ministry and bureaucracy.	The RBI governors are appointment by the Central Government. Although RBI states that the Central Government may give directions to the Bank, after consultation with the Governor, where considered necessary in public interest, there has been no instance so far of the Government exercising its this power.(RBI website)	SEBI reports to the Ministry of Finance. Policy formulation is done by Ministry of Finance.	The TRAI reports to the Ministry of Communications & IT. Policy formulation is done by Ministry of IT & Telecommunications.
Office of Ombudsman/ Consumer Protection	Yes , 15 Banking Ombudsmen mostly in state capitals (RBI Ombudsman)	No ombudsman. SAT (Securities Appellate Tribunal) is there.(SEBI Ombudsman)	Yes, TRAI has instructed the Telecom Operators to constitute a two- member Grievance Redressal Committee that has a member each from the Telecom operator and registered consumers organizations.(Telecom Consumers Complaint Redressal Regulations, 2012)

Parameter	RBI	SEBI	TRAI
Process of Policy & Regulation formation	Monetary policy decisions are made by the Governor. The Governor holds structured discussions &consultations with the four Deputy Governors. Final decision is taken by the governor. The Governor also consults with banks, financial market representatives, trade bodies and industry associations. Close to the policy decision, the Governor meets the Prime Minister and the Finance Minister informally. RBI Policy Formation) No voting done.	Very transparent system. Before notifying any Regulations, SEBI issues a public concept note (or policy paper) of the proposed regulationswhich is posted on SEBI's website.The responsesare collected from public and are then internally debated within SEBI. The revised draft is then circulated for consideration andapproval of SEBI board. (SEBI also has committees, consisting of experts and policy makers, torecommendcontents ofregulations. Theystudy the matterand present theirrecommendations in a reportwhich is firstplaced beforepublic for aperiod of time for comments. Atthe end of thisperiod, SEBItakes a decisionand theregulations areamended).Afternotification in the official Gazette, the regulations are placed in the house of Parliament.(SEBI Policy Formation)	The TRAI through process of policy - making invites the participation of stakeholders. The recommendations are then submitted to the Telecom Commission for approval. Neither discussions with TRAI nor those in the Telecom Commission are made public.
Financial Autonomy	Totally self-funded.(RBI Annual Report,2013)	Funds come from Central Government and from its working (e.g. service fee, annual fee, listing fee, regulatory fee, registration fee, application fee, FII registration fee, etc.)	The TRAI is funded by the Consolidated Fund of India but the budget is approved by Department of Telecom. There is no provision in the present system for any other source of funds for TRAI.(TRAI Act, 1997)
Leadership & Tenure of Chairperson of the regulator	Prime Minister/ Finance Minister decides the Governor. Tenure is 3 years (extendable by 2 years) and retirement age is 62.(RBI Governor Tenure)	Chairman and the Whole Time Members may hold office for a period of 3 years (can be re-appointed by the Government). Max age limit is 65 years. (SEBI Chairman Tenure)	Central government elects the TRAI chairman is appointed for a period of three years (not extendable).(TRAI Act, 1997)

Profile of the past & current chairmen	Leading Economists, highly qualified usually masters or doctorate in Economics, usually IAS officers, several years of experience in financial sectors at national and international level (RBI Governor Profile)	Generally, the Chairman is an IAS and/ or served as a Chairman or MD in a Financial body (like UTI Mutual Funds, LIC, etc) and having at least 25 years of experience in their field.	The past chairman of TRAI have been former IAS officers of the Government or retired Judges.
Capacity building for Human Resources	National Institute of Bank Management (NIBM),Indira Gandhi Institute of Development Research (IGIDR), and Institute for Development and Research in Banking Technology (IDRBT)and The Centre for Advanced Financial Learning in Mumbai are some of the RBI-funded institutions for advance training and research on banking issues, economic growth and banking technology.	Vacancies are advertised on SEBI's website (then a test and Personal Interview is conducted). For Chairman the vacancy is advertised by Ministry of Finance. National Institute of Securities Markets (NISM) is a public trust, established by SEBI. NISM offers a course of 1 year full-time Post Graduate Program in Securities Management. But SEBI does not make recruitments directly from NISM.	Existing officials in TRAI receive continuous professional trainings in the emerging areas through collaboration with premier institutes in India & abroad.

however, changed this trend by appointing an academician as the RBI governor. This practice should be adopted by other sector ministries.

5. Another common characteristic observed is that the Chairman of all the regulators can be dismissed by the Government without the need for approval from any other constitutional body. This means that none of the regulator heads are constitutional appointments as is the case with regulators like Federal Communications Commission (FCC) in the US and Office of Communications (OfCom) in UK. This undermines the functional autonomy given to the regulator.

5. Conclusion & Recommendations

1. As is the case with all other regulators, Licensing and the policy implementation function needs to be given to the TRAI. This will enhance the autonomy and credibility of TRAI as the sector regulator.
2. The Regulator can also be shielded from political influence and interference if it reports directly to the Parliament. The TRAI should be reporting to the Parliament directly instead of the current system of reporting to the Department of Telecom and the Minister.
3. In the consumer redressal mechanism, the TRAI has relied on self-regulation for satisfactory redressal, this is a novel method used whose effectiveness will be ascertained over a period of time.
4. The Department of Telecom (DoT) or the Telecom Commission (TC) does not participate in the consultation process and hence the stakeholders are not aware of their opinion on a particular issue. This will be overcome if the DoT and TC participate in the consultation process.
5. The transparency of decision making can be enhanced if the minutes of the regulator meeting are maintained and board members vote for/against. This increases the credibility and accountability of the regulator incase the decision is contested. This is a good practice and it needs to be adopted by TRAI.
6. Like other regulators, the TRAI should also be funded directly from the Consolidated Fund of India and not through the DoT as it is currently funded. It should also be funded through regulatory fees contributed by industry. This will help lessen the burden on the Government.
7. TRAI does support any academic institutions for capacity building. In the absence of this, it has to rely on the services of officers of DoT and Bharat Sanchar Nigam Ltd.

6.1. Limitations of the Study

The authors have chosen to study only three regulators in this paper. This even in the case of qualitative comparative analysis may not be enough for generalization. As this research is based on published data about the selected sector regulators, informal/unwritten issues may have been ignored.

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Analysis of Recent International M & A Trends in Telecom Industry - A Case Study

Abhijit Chirputkar*, Yatin Jog**

**Assistant Professor – Finance, Symbiosis Institute of Telecom Management Symbiosis International University, Pune, Maharashtra, India. E-mail: chirputkar@sitm.ac.in*

***Assistant Professor – IT, Symbiosis Institute of Telecom Management, Symbiosis International University, Pune, Maharashtra, India. E-mail: yjog@sitm.ac.in*

ABSTRACT

The corporate world aims at maximisation of profits and wealth. One of the main objectives of any profit making enterprise is to maximise shareholders wealth. These objectives can be achieved by way of organic growth and / or inorganic growth. In value creation, M & A have assumed great importance which is in the form of inorganic growth.

The telecom industry in the world has observed constant changes and accordingly the companies in this industry have changed their business models to achieve these objectives. In the recent past telecom industry is also facing challenges due to convergence issues. Value creation thus has become a challenge. Telecom Industry in India as well as all over the world has observed various M & A activities in the recent past. The objective was to find out the main objectives and driving forces in various M & As. For the purpose of our study we have relied on Case Study based approach and selected three cases.

The telecom industry and its eco system consist of various players. We have selected cases based on a few criteria such as it is an international acquisition (i.e. in foreign countries), players in M & A are from the same eco-system, period of observation is of two years i.e 2012 & 2013 and one of the companies is a leading handset manufacturer.

On the International front also a few M & A have shown a specific trend and the same is observed and analysed in the cases of Motorola and Google, Microsoft and Nokia and Sony Ericsson and Sony Mobile Corporation. The study concludes with key findings and likely trend in the industry in the near future.

Keywords: Mergers & Acquisitions, Motorola-Nokia-Ericsson

1. INTRODUCTION

The corporate world aims at maximisation of profits and wealth. The ecosystem of telecom industry is changing fast due to various reasons such as changing regulations, technology, consumer preferences, and convergence issues. These have led to change in the business models of a few companies. Due to globalisation, even established companies had to face problems on various fronts and forced them to accept a mode of restructuring by way of mergers and acquisitions.

In the entire telecom ecosystem, there are various companies such as technology companies, chipset manufacturers, network / infrastructure providers, VAS companies /content developers, handset manufactures, service providers, IT/ software solution providers, application vendors, regulatory bodies, end users etc. In the entire ecosystem M & A is already taking place and the scope of study would be unlimited considering its complex structure.

Thus study is restricted focusing only the handset manufactures in this ecosystem. There are various handset manufacturers such as Nokia, Samsung, LG Electronics, Sony Ericsson, ZTE, HTC, Apple, RIM – BlackBerry, Motorola, Huawei etc. These companies are in existence for a long period of time and their market share is also changing year on year. For the purpose of our study we have selected three handset manufacturers who have completed the process of M & A in the last two years i.e. 2012 & 2013. The cases include study of Motorola-Nokia- Ericsson and its subsequent analysis.

2. The Objectives of the Study

In the recent past a few M & A have taken place in telecom industry i.e. equipment manufacture and internet service providers / IT service providers etc. The objective is to understand the contemporary events related to M & A and to analyse them to arrive at some conclusion.

There are various aspects to study for M & A, which include areas of strategies, organization theory, accounts &finance, economics, organization theory and HRM. It results in ignoring research findings in the other areas (Larsson and Finkelstein (1999). So our attempt is to focus on techno-commercial aspect of above M & A rather than purely finance or management perspective.

3. Methodology

We have adopted a case study based approach to understand and evaluate the recent trends in M & A. One of the main objectives of this approach is to study M & A which have taken place in relation to handset manufacturers. The study explains "how" it has taken place and major learning from the same. A case study based approach is a detailed study of several cases which are unique to a research topic i.e. in this case study; we tried to explore the basic objective / unique feature of M & A in three cases. The unique aspect / feature is observed and observations are drawn on this.

Allport (1937, 1962) introduced the terms 'nomothetic' which means general laws & procedures of exact science and focuses more on quantitative terms similarly another term 'idiographic' which indicates understanding of a particular case / cases focuses more on qualitative aspects. These can also be applied in M & A cases. The case study method belongs to the second school of thought i.e. idiographic which can be applied in cases of M & A. The process involved includes (Glaser and Strauss (1967) performing multi-case studies (between 2 to 10 cases), carry out comparative analysis which results in hypothesizes and theory which can be generalised (Eisenhardt, 1989:548).

A case study requires study of an event or a set of related events. The study should aim at describing the events and the phenomenon of interest (p. 302). According to Stake (1995), the collective case study is the study of a number of cases in order to enquire into a particular phenomenon.

4. Facts of the Cases:

4.1. Case 1: Motorola & Google

4.1.1. Motorola Mobility

Motorola Mobility was formed in January 2011 after, US based Telecommunications Company Motorola Inc. was divided into two (namely Motorola Mobility and Motorola Solutions due to $4.3 billion loss from 2007 to 2009) independent public companies.

The main business of Motorola was to design and sell wireless network infrastructure equipment,broadcast as well as home network products (including set-top boxes - this part of the business was subsequently sold by Google Inc. to Cable equipment maker Ariss Group Inc. for $2.35 billion) & cable modems, smartphones, digital video recorders, and network equipment which were used forhigh-definition television, video broadcasting etc.

Motorola was first one to launch handsets using TDMA, CDMA and GSM, first one to launch walkie-talkie, FM Portable Radio, portable consumer phone Dyna TAC, first portable cell phone Star TAC and a Linux OS based handset.

4.1.2. Google Inc

Google Inc. is an American corporation established in 1998 specialized in Internet-related services as well as products. The services and products include search engine, cloud computing and various software, online advertising technologies. The company has taken a lead in developing the mobile operating system i.e. Android. The operating system is freely available and promotes app development and content sharing with developer.

The first search engine and Doodle was launched in in 1998. Some of the technological success factors of Google include launch of Gmail in 2004, Google Maps and Google Earth in 2005, YouTube in 2006, Android Operating system for mobile devices in November 2007 and Chrome browser in 2008.

4.1.3. Causes of Google Acquiring Motorola

Motorola Inc. was acquired by Google Inc. in August 2011 (the process completed in May 2012) with an estimated price of $12.5 billion. It is a vertical merger. Motorola Mobility – a hardware company is acquired by a

Software Company / internet giant i.e. Google. Motorola was sustaining losses whereas Google was a profit making company. The former was strained in cash whereas the latter was a cash rich company.

Google has Android operating system which is open-source is being used by Motorola. However the same was under patent legal battle. (for alleged patent infringement suit from Microsoft, Oracle and Apple.) Acquiring Motorola was a step towards resolving these issues. Motorola Mobility relied on Android OS for its smartphones.

As Google led the operating system of Android, Motorola Mobility used Android operating system for its smartphone devices. Thus two major players such as Google for its software; and Motorola Mobility for its devices, if combined would help in faster innovation. Motorola Mobility was great in innovation in communications technology which has resulted into development of intellectual property. With both the companies coming together, it will help in terms of IPRs i.e. building Google's patent portfolio. Android as an operating system was facing anti-competitive threats from Apple, Microsoft, and other companies. Motorola Mobility has approximately 17,000 granted patents and 7500 patent applications which were pending, thus totalling to 24500 patents. Deal enables Google to take an advantage of Android as an operating system and mobile computing in the form of devices.

4.1.4. Effect of Acquisition

Since Motorola Mobility's has patents, it will help to protect operating system of Android ecosystem. Google can create synergy in terms of patents acquired from Motorola, operating system, and create dynamic devices.

4.1.5. Motorola's Subsequent Acquisition by Lenovo

Google purchased Motorola for almost $12.5 billion with major objectives of controlling patents. Now Motorola is sold to Lenovo at a massive loss at a price of $2.91 billion. Lenovo is a Hongkong Corporation. Thus it indicates expensive deal for Google. Lenovo is a Chinese electronics company with excellent distribution network and expected to have an edge for smartphones. Now Lenovo can concentrate on by accessing US and Latin America market by acquiring Motorola. The real issue is control on Motorola's patents. Post above acquisition, Google will continue to hold Motorola Mobile patent portfolio which will be leased to Motorola back.

4.2. Case 2: Microsoft & Nokia

4.2.1. Microsoft

Microsoft Corporation is an American public multinational corporation. The major business includes development, manufacturing, licenses, and support to products, services, IT solutions in relation to computing and with a main focus on software. The company was formed in 1975. It is one of the world's most valuable companies in terms of market capitalisation and branding. Some of the technological success factors of Microsoft include MS-DOS, Microsoft Windows line of operating systems and Microsoft Office suit.

Microsoft has dominated PC operating system and office suite markets. Apart from this, it has also produced a wide range of other software, internet search , mobile phone operating system, video game industry , the digital services market.

4.2.2. Nokia

Nokia Corporation is a Finnish multinational company. It has a main focus on communications and information technology. Nokia was formed in 1865. The main business includes hardware products such as mobile telephones, portable IT devices, IT related products and services and applications such as games, media and messaging, digital map information and navigation services. Nokia's another company i.e. Nokia Solutions and Networks provide telecommunications network equipment and services.

By the fourth quarter of 2012, Samsung achieved the first position in terms of mobile phone maker followed by Nokia (the market share being 18.0%). However subsequently, Nokia only has left with a 3% market share in smartphones. They lost almost 40% of their revenue in mobile phones in Q2 2013.

Microsoft acquired Nokia in 25th April 2014 (although process started in September 2013). In 2008, Nokia acquired Symbian Ltd. which provides Symbian OS for Nokia phones. Nokia's Symbian operating system was failed post 2011 and then switching to Microsoft was an obvious reason. With the introduction of smartphones and tablets, mobile phone and handset sale was affected. It has also affected on Nokia's production. Average Nokia

R & D expenditure was around 14% of the sales (in 2010) which is significant which may have resulted in development of IPR.

The acquisition includes 3.79 billion euro for Nokia's devices and Service business including key patents;1.65 billion euro for a broad intellectual property licence. In this IP and patent agreements have material value. Mobile phone business provides an entry into other markets; it would result into long term value creation.

4.2.3. IP Acquisition and License Agreements with Nokia

Since the mobile handset market, smartphone market and related business is mainly driven by patents, the above merger would help Microsoft to get an advantage of patents. Microsoft is acquiring over 8,500 design patents (except NSN), ownership of Lumia and Asha brands and a 10 year licence to use the Nokia brand on feature phones. The cost of license to Nokia's utility patents to Microsoft was almost 1.65 billion euro. Nokia holds an excellent patent portfolio related to technologies and wireless technologies. This portfolio consists of 30,000 utility patents and patent applications.Thus the licence and patents are valuable for Microsoft's business strategies. Nokia is assigning to Microsoft benefits under more than 60 patent licences with third parties such as Qualcomm, IBM, Motorola Mobility and Motorola Solutions. Microsoft will get a benefit in terms of royalty arrangements which Nokia had negotiated. Put all together, Microsoft will have the most cost effective patent arrangements for smart devices. Microsoft already had an extremely strong patent portfolio.

4.2.4. Case 3: Ericsson & Sony Mobile Corp

Sony Corporation (incorporated in May 1946) is in Japan. In October 2001, a joint venture (50-50) "Sony Ericson" was entered between Sony Corporation and Ericsson (Sweden). On 15th February 2012, Sony acquired remaining 50% equity interest in Sony Ericsson from Ericsson. Thus due to this, Sony Ericsson has become wholly-owned subsidiary of Sony and the name was changed to Sony Mobile Communication. Sony Mobile, manufactures and sells mobile handsets with a specific focus on smartphones using Android as an operating system.

It has helped Sony in acquiring ownership of five essential patent families related to wireless handset technology. The total consideration was 107174 million yen i.e. 1050 million Euros. Thus Sony Corporation is 100% owned Sony Mobile Communications.

Sony Ericsson has released new models based upon digital photography and multimedia capabilities including built-in digital camera & colour screen. The product range of Sony Ericsson includes the first mobile phone based on UIQ 3 - P990, world's first 8-megapixel phone and the first 12-megapixel phone, named Satio, which runs on Symbian Operating System 9.4. It could successfully prove that it has released 'people phone' with a specific focus on high quality built & entertainment. Sony Ericsson had various technological innovations.

4.2.5. The Buyout Plan

Sony Ericsson was established back on October 1, 2001, with an objective of using specialised areas of both the companies. Sony was expertise in consumer electronics whereas Ericsson's was expertise in phone and network knowledge. The joint venture lasted for about 10 years."Sony Mobile Corp." acquired Ericsson's 50% share from "Sony Ericsson" on Feb 16th, 2012. It made a payment of € 1.05 billion to Ericsson in cash. As part of this deal Sony acquired 5 patent families along with a broad IP cross-licensing agreement with Ericsson. It would lead to the two companies' initiative of connecting across multiple platforms.

Ericsson is a Swedish Company provides telecommunication systems and mobile networks. Ericsson was one of the top cellular telephone handset manufacturers however took a setback due to unavoidable reasons of shortage of inputs affecting its production.

Sony is a Japanese consumer electronics company. Sony was also one of the companies in cell phone market. Sony and Ericsson discontinued manufacturing own mobile phones and concentrated more on phones having multimedia features. Since the date of Joint Venture, it was very difficult to earn profits and the venture actually sustained huge losses. In 2008, the company could achieve a status of third largest mobile phone manufacturer after Nokia and Samsung.

4.2.6. Reasons of Acquisition

Sony had a decreasing market share due to decrease in popularity of feature phone market and losses of $ 317 million in Q4 of 2011. Sony sees smart phones as integral part of its tablet, PC and video game console market. This shall help integrate its software and hardware innovations into smartphones. It facilitated opening up of new world of

Sr.No.	*Comparative Aspects*	*Case 1*	*Case 2*	*Case 3*
1	Name of Acquirer	Google	Microsoft	Sony
2	Year of Formation of Company	1998	1975	1946
3	Country of Incorporation	USA	USA	Japan
4	Financial Status	Profit making and cash rich	Profit making and cash rich	Profit making
5	Nature of Business of Acquirer	Software and Internet related product and services	Software, IE and then by manufacturer with best products such as Windows OS	Electronics, products related to audio, video, IT etc. Entertainment
6	Main purpose of acquisition for acquirer	Patent acquisition and to overcome patent related issues	Patent acquisition	Patent acquisition and restructuring into telecom business
7	Name of Target Company	Motorola	Nokia	Ericsson
8	Year of Formation of Company	1928	1871	1876
9	Country of Incorporation	USA	Finland	Sweden
10	Financial Status	Loss making and defunct in 2011	Loss making in Q-2 of 2013	Loss making
11	Nature of Business of Target Company	Handset manufacturer	Handset /mobile products manufacturer and software	Mobile phones
12	Main purpose of acquisition for Target Company	To come out of losses and restructuring	To come out of losses and restructuring	To come out of losses and restructuring
13	Number of Patents with Target Company	Approx. 24500 patents (17000 granted and 7500 pending)	Approx. 8500 design patents and 30000 utility patents	Approx. 35000patents largest holder of patents for standard essential patents for mobile communication
14	Year of Acquisition	May 2012	September 2013	February 2012
15	Value of Acquisition	$12.5 billion in cash	In cash Euro 5.44 billion (including licenses and future options with Euro 1.65 billion for patents)) or $7.17 billion (includes $2.18 billion for Nokia's Patents)	1.05 billion Euros
16	Main purpose of acquisition	Convergence of digital communications, information systems, consumer electronics, software providers, internet services and facility, content on net, rapid changes in technologies and resultant impact on handset and contents, Focus on cloud computing Financial impact in terms of profits and valuations Maximisation of shareholder's value Control on Intangible assets Main driving force in the form of Operating systems		
17	Role of IPRs (Patents / Intangible assets acquisition)	Patents IPRs Key Employees	Patents IPRs Key Employees Production facilities	Patents IPRs Key Employees

online entertainment to SONY mobile users with SONY Play station Network and SONY Entertainment network. Whereas for ERICSSON: In 1993, Ericsson sold around 8 lac phones however in 1999, it reached to 32 million. However from 1998 to 2001, it faced various issues and problems resulting into huge losses. Sony Ericsson's market share fell from 3% to 1.7% in 2011 subsequently Sony acquired Ericson's share in the venture in February 2012.

5. Comparative Analysis

5.1. Analysis

For the purpose of analysis, we have considered three cases of mergers and acquisitions. The comparative chart indicates that out of three acquirer companies, two are from USA where as one from Japan. The main business of the acquirer companies is providing services in the field of Information Technology, Software services and Internet. All the three target companies are mobile handset manufacturers. Based on year of establishment, the companies which are incorporated later (newly formed) are taking over old companies (Motorola, Nokia, Ericsson - Mobile). It may be an indicator of requirement of changes in the business models for technology companies for its sustainability. The acquirer companies have huge profits, assets and cash rich whereas the target companies were in losses and comparatively less cash however these companies were very rich in terms of intangible assets i.e. IPR – patents; licenses and human employees. The target companies hold huge number of patents and thus it has become one of the main reasons of acquisition / target for acquisitions. Thus the role of IPR ispre dominant in acquisitions. One of the main aspects was also to control on employees of target companies. The acquirer companies hold operating systems and software which has played an important role in acquisition. The target companies although handset manufacturing companies had to rely on operating systems and software solutions provided by acquirer companies. These companies wanted to have major control on handset manufacturing business for growth. Operating systems are used in PCs, Smartphones and Tablets. If we observe the trend of sales in these three segments, the demand for PCs is falling (share is 20%) where as demand for Smartphones and Tablets is increasing (share is almost 80% in 2013). The acquisition in all above three cases indicates the importance of operating systems or software applications over handset manufacturing activity. Even Blackberry Ltd. announced that the company was open for being purchased on 12th August 2013. One of the reasons here is same- fall in demand of its handsets, importance of operating systems in the entire ecosystem. Changes in technology, consumer preferences are main reasons to drive target companies for mergers and acquisitions.

There are ten major handset manufacturers out of which three players have already faced the challenges of mergers. Out of ten handset vendors, almost six are using Android (in terms of market share of all operating systems, it is almost 78.6%) whereas others are using other operating systems. Considering the market share of various vendors, the major gainers are Samsung, Apple followed by LG, Lenovo (which has subsequently acquired Motorola) etc. It would be possible that the others have almost 34% market share in terms of handset manufacturers, if any of these manufacturers have their own operating systems, then it would really drive the market.

6. Conclusion

The telecom industry always faces the challenges from technology up gradation, convergence issues and uncertain ecosystem which mainly includes consumer preferences. The trend in the mergers and acquisitions in the recent past has clearly shown the importance of changing customer preferences, driving force / role of operating systems as a part of selling handsets, financial positions of handset manufacturing companies, IPR / patents. The global market share of PCs is decreasing whereas for smartphones it is increasing. Thus this has also shifted focus on operating systems, patents to make changes in newer models. It clearly indicates growing importance of operating systems and software industries taking over handset manufacturing companies. It would be interesting to observe whether operating system plays a role in selecting the handset as one of the consumer preferences. (As the market share of Android has gained a lot during 2012-13.) The consumers have shown a preference of tablet and smartphones over personal computers. The gaining importance of smartphones, selection of operating systems and position of other players in terms of profits and cash would drive the future trends in mergers and acquisitions of telecom industry. Considering the competition in the smartphone market, cost will also play an important role. It would be interesting to observe the competition from players from China with existing top players i.e. Samsung and Apple.

APPENDIX

Table 1: MajorHandset Manufacturers and Operating Systems Used:

Sr.No	*Name of the Company*	*Operating System used*
1	Nokia	Symbian (till 2011), Microsoft Windows (2011 onwards)
2	Sony Ericsson	Sony Ericsson Java Platform 7 (Java ME)
3	Motorola	Android
4	Samsung	BADA, Android
5	LG Electronics	Android
6	ZTE	Android
7	HTC	Android
8	Apple	iOS
9	RIM – BlackBerry	BlackBerry OS
10	Huawei	Android

Table 2: Market Share of Mobile Phone Manufacturers in 2013

Sr.No.	*Name of vendor*	*2013 Market Share (%)*	*2012 Market Share (%)*
1	Samsung	24.60%	22.00%
2	Nokia	13.90%	19.10%
3	Apple	8.30%	7.50%
4	LG	3.80%	3.30%
5	ZTE	3.30%	3.90%
6	Huawei	2.90%	2.70%
7	TCL	2.70%	2.10%
8	Lenovo	2.50%	1.60%
9	Sony	2.10%	1.80%
10	Yulong	1.80%	1.10%
11	Others	34.00%	34.90%
		100%	100%

Source: © Gartner (Feb 2014) and http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/a

Table 3: Major IT Service Providers/Owners of Operating System:

Sr.No.	*Name of the OS Company*	*Name of the Company*	*Global smartphone operating system share (%) in 2013, according to IDC © IDC (Jan 2014)*
1	Android	Google	78.60%
2	iOS	Apple	15.20%
3	Research in Motion (RIM)	Blackberry Ltd	1.90%
4	Windows	Microsoft	3.30%
5	Linux and others	Open Source	1.00%

http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/a

Table 4: Market Share of Major Operating Systems

Name of vendor	*2013 Market Share (%)*	*2012 Market Share (%)*
Android	78.60%	69.00%
iOS	15.20%	18.70%
Microsoft	3.30%	2.40%
BlackBerry	1.90%	4.50%
Others	1.00%	5.40%
Total	100%	100%

Source: © IDC (Jan 2014) and http://mobithinking.com/mobile-marketing-tools/latest-mobile-stats/a

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Symbiosis Knowledge Village Near Lupin Research Park Village
Lavale, Mulshi Tahasil, Pune - 411042 Ph.: 39116170, 39116180
Fax: 39116181 E-mail: gghallur@gmail.com, Website: www.sitm.ac.in