East African Communications Organisation

Communications for all in East Africa

FRAMEWORK FOR ESTIMATING THE DIGITAL TERRESTRIAL TELEVISION TRANSMISSION FEES

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1.0 INTRODUCTION

This paper presents a framework for estimating the Digital Terrestrial Television (DTT) transmission fees that will be charged by Multiplex Operators to Content Services Providers per content channel. Determination of optimal transmission fee is critical to the successful migration from analogue to digital terrestrial television broadcasting system. This optimal is needed to ensure that content producers pay a cost based fee to multiplexers and at the same time multiplexers recovers their cost of investment and plus a reasonable rate of return. Payment of this fee can be monthly or on a per bit stream basis. In the final analysis the billing method will be determined by among others: the simplicity of establishing the amount due at the end of a given period; the amount and complexity of reconciliations involved; and the degree of monitoring and auditing to ascertain the actual consumption of services and the correct amount to be billed.

1.1 Network Elements of the MUX and Core cost centers

Understanding of DTT network is critical to the determination of DTT fee, the key network elements that forms DTT are Multiplexer, Transmission Link Network and Transmission System as shown in the figure 1 below. Each of these network elements (also referred to as cost centers) are made up of several equipment to which capital expenditure (CAPEX) and operating expenditure (OPEX) are allocated in varying proportions.

The abovementioned equipment are critical to the functioning of any multiplexing set up. It should be noted that there is other equipment that provide services to different and must therefore have their costs shared amongst different the MUX stations in the country, and some equipment operated on a standalone basis at each MUX station.

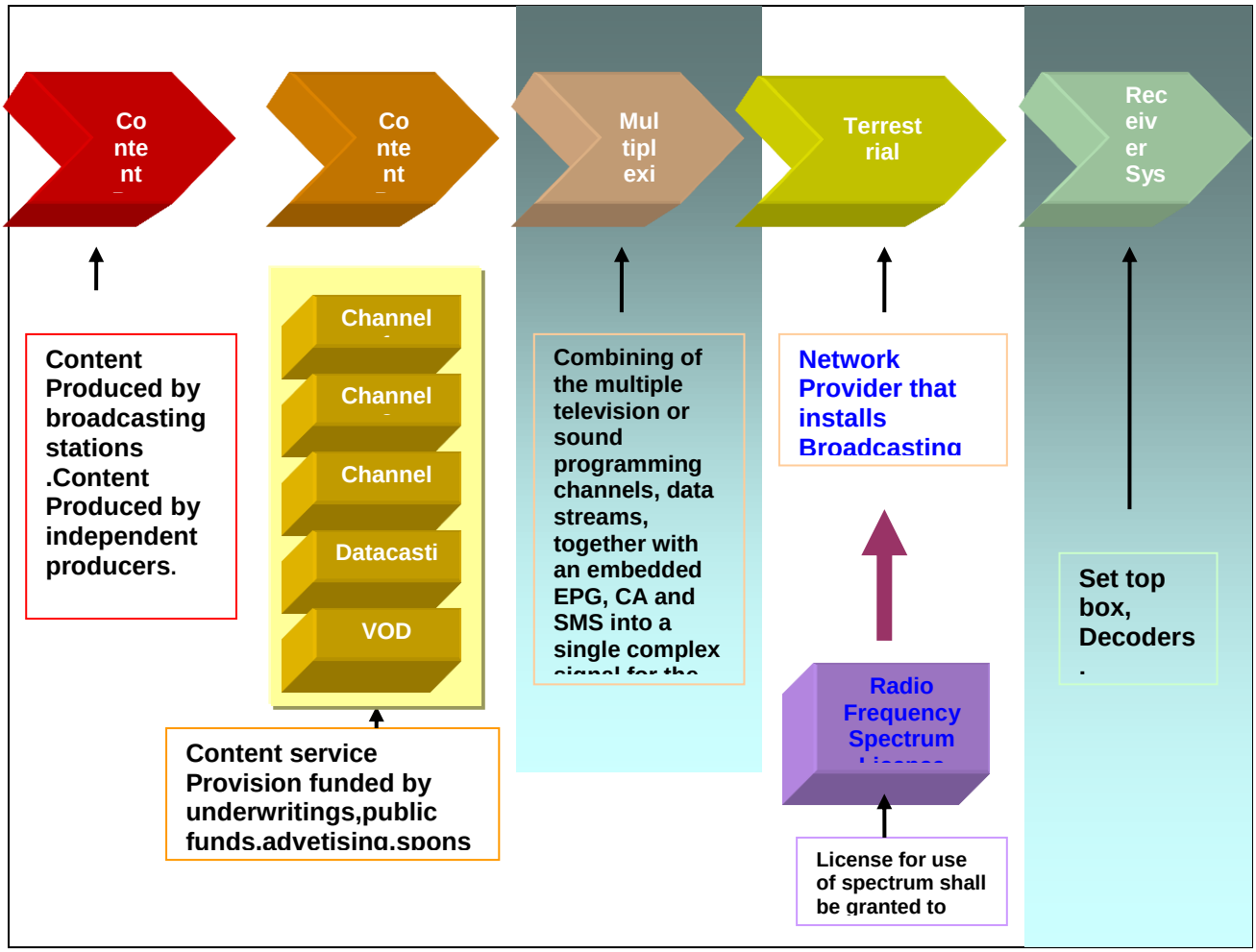
Figure 1: Network elements of the MUX and core cost centers

Head-End/Multiplexing System	Transmission Link Facilities	Transmission Site System
• Encoders • Multiplexing switch • Management & Monitoring system • Software Licenses • Conditional access system • IT Network (Servers, Routers, switches, cabling, security) • Cooling system • Power system • Modulator equipment • Initial installation of multiplexer equipment, cooling system, power system • Spectrum	• Microwave links • Optic fiber • Satellite links	• Transmitter equipment • Modulators/demodulators • Mast/Tower • Antenna & feeder System • TVRO • VSAT • Terrestrial antennas • Power system • Power supply • Diesel Generators • UPS • Cooling system • Initial installations for transmitter, antennas, cooling system, tower, generator

1.2 DTT Value Chain

The DTT value chain includes activities or value-adding processes that a firm operating a MUX must undertake in order to deliver DTT services. In this setup, the Schematic DTT value chain is divided into five parts, namely: Content production, Content service provision, Multiplexing, Terrestrial delivery network and a Receiver system as shown in the figure below.

Figure 2: Schematic diagram of a DTT value chain.



The DTT Transmission Fee Determination Framework includes the following items:

- The use of an efficient cost methodology;
- The DTT network design and architecture (topology);
- Determination of the Weighted Average Cost of Capital (WACC) (since the DTT network is normally financed by debt and equity funding);
- Annualised Capital Expenditure (CAPEX);
- Estimation of Operating Expenditure (OPEX);
- Derivation of total annual costs;
- Derivation of the DTT transmission fees per content channel per site per month.

2.0 THE USE OF THE EFFICIENT COST METHODOLOGY

Fundamentally, there are four commonly used cost methodologies; namely, Marginal Cost (MC); Fully Allocated Cost (FAC); Stand Alone Cost (SAC) and Long Run Incremental Cost (LRIC). The LRIC methodology is recommended for estimating DTT transmission fees per content channel per site per month for the following main reasons:

- It only measures/allocates relevant, efficient, direct and attributable network related costs;
- It only reflects levels of costs that would be incurred by efficient MUX network operator in a competitive and contestable market.

The LRIC methodology only allocates two major cost components; namely, Network Related Capital Expenditure (NRCAPEX); and Network Related Operating Expenditure (NROPEX), as the efficiently incurred costs.

3.0 THE DIGITAL TERRESTRIAL TELEVISION NETWORK DESIGN AND ARCHITECTURE

All major network elements involved in the design and architecture of the main and booster DTT network by satellite or Optical Fibre Cable (OFC) as media for signal distribution are analysed and identified. The identified networks then form the basis for establishing NRCAPEX and NROPEX. Shared networks elements for the main DTT network, Local signal insertion for district/regional coverage and booster DTT networks (such as DVBHead end, Satellite transponder and uplink satellite antenna earth station) also have to be identified. The value of the CAPEX and OPEX for these shared network elements can then be divided by the number of sites to be covered by MUX operators in the country.

4.0 DETERMINATION OF THE WEIGHTED AVERAGE OF COST OF CAPITAL

A DTT network is normally financed by debt and equity, therefore the Weighted Average

Cost of Capital (WACC) can be estimated using each source of capital (debt and equity) from the following formula:

- **WACC = Cd x D/(D+E) + Ce x E/(D+E)** (1)

  where, Cd is the pre-tax cost of debt, Ce is the cost of equity, D is the value of the operator's debt and E is the value of the operator's equity.

The Ce can be estimated using the Capital Asset Pricing Model (CAPM) as follows

$$C_e = R_f + \beta \times (R_m - R_f) \quad (2)$$

- Where R_f risk free interest rate and is referred to as a yield of 10 year Government Bond issued recently by the Central Bank of the country
- β is equity beta, refers to level of volatility of the return of market vs investment, and its value for different investments in developing countries like Africa is at most 1.
- $R_m - R_f$ is equity risk premium, and its arithmetic or geometric mean for different investments in developing countries is between 4 and 6.

The WACC as the minimum expected return for the MUX operator is then used to annualize its CAPEX in a manner detailed in the next section.

5.0 ANNUALISATION OF CAPITAL EXPENDITURE

The established CAPEX of the network elements from the DTT network design and architecture are annualized to get an annual value of the CAPEX (annualized CAPEX) using the following formula:

$$\text{Annualized CAPEX} = \text{CAPEX} \times \frac{i(1+i)^n}{(1+i)^n - 1} \quad (3)$$

where $\frac{i(1+i)^n}{(1+i)^n-1}$ represents the annualization factor, i is the interest rate and referred to as the WACC of the DTT network and n is the economic lifetime of each network element identified from the DTT network design and architecture and added together to get the total annualized CAPEX. Table 1 below provide an example of Annualized CAPEX data generated by the aforementioned formula in terms of the lifespan and market value for each network equipment.

Table 1: Example of Annual charges on Assets (Annualized Figures) using the formula

CAPEX Element	**Current Market Value (USD)**	**Current Market Value (USD)**	**Lifetime (years)**	**Annualised CAPEX**	**Annualised CAPEX**
	Main DTT Network using OFC	**Local Signal Insertion for District coverage**		**Main DTT Network using OFC**	**Local Signal Insertion for District coverage**
Assumed Number of Sites	20.00	20.00			
DVB Head-end Equipment (USD 100,000)	50,000.00	50,000.00	5	17,207.44	17,207.44
Downlink Equipments and other accessories	50,000.00	-	10	12,464.94	-
Tower (self support)	100,000.00	100,000.00	25	21,492.49	21,492.49
DVB-T Transmitter and Accessories	80,000.00	80,000.00	5	27,531.91	27,531.91
Initial Licence Fee	20,000.00	20,000.00	25	4,298.50	4,298.50
OFC Initial charges and Terminal Equipments	6,441.72	-	15	1,453.50	-
Gigacaster for converting radio signal to optic signal	7,423.31	7,423.31	10	1,850.62	1,850.62
TOTAL	**313,865.03**	**257,423.31**		**86,299.40**	**72,380.97**

6.0 ESTIMATION OF THE NETWORK RELATED OPERATING EXPENDITURE

The network related OPEX is estimated by adding the costs for the network operation and maintenance, salaries of network related personnel, spectrum fees, cost of electricity and satellite bandwidth rental fee (This fee can be apportioned between different DTT booster networks by dividing it by the number of sites to be deployed in the country).

7.0 DERIVATION OF TOTAL ANNUAL COST

The total annual cost can be derived by adding the total annualized CAPEX and total OPEX as follows:

Total Annual Cost = Total Annualised CAPEX + Total OPEX (4)

8.0 DERIVATION OF THE DTT TRANSMISSION FEES PER CONTENT CHANNEL PER SITE PER MONTH

The DTT transmission fees per content channel per month per site can be obtained by dividing the total annualized cost by the total number of utilized channels (it include all Free to Air channels provided in the country and pay TV channels) and the number of months (12) in a year plus a margin of 10% to cater for common costs.

Pay channels utilize the same network elements as FTA channels, however, the fee being determined is specifically for the Free to Air content services providers, since the fee for pay channels is presumed to be competitively negotiated.