

# Identification of Bulk CM File Status in EMS

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**Abstract-** Cellular 3G-network usually often have poor penetration and response in certain areas such as indoors. A fem to cell is a device that is used to increase the strength of the wireless signal in a small area, mainly indoors. This is a small cellular base station, also known as a wireless access point that connects to the Internet connection and transmits it to the radio in the coverage area. Fem to cells can be deployed in different places and there is a need for a control system to ensure the possibility of FCAPS functionality for this device. Fem to device must be set up and registered on an element management system (EMS). In the process of configuring devices, bulk CM-file is produced, which is loaded and used by the fem to cell. This paper proposes a methodology to register the fem to cell and determine the status of bulk CM file.

**Index Terms**—Fem to cells, Element Management System, TR-069 protocol, SOAP/JMS protocol

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## I. INTRODUCTION

Mobile communication plays a very important role in the economic and social development in most countries, as shown in the work of the Broadband Commission. Increase in the number of mobile users has led to the need for high-speed, reliable and smooth network connection. With this high rate of innovation in the smart mobile devices and applications, there is a growing demand for wider coverage and higher data rates. [3] It is worth noting that most of the data traffic generated indoors, in homes, offices, or other public hot spots, such as shopping malls, airports, train stations, etc.

However, cellular signals under these conditions suffer from multipath fading, penetration and scattering effects and other losses. Many solutions are offered such as distributed antenna systems, picocells and Wi-Fi, but they are not very effective in terms of performance and cost. A fem to cell is a technology that provides a low-cost efficient service network [4]. Wider use of broadband and mobile phones for video telephony / conferencing, application / music download and online games are the drivers of fem to cell market.

As per a new report from Allied Market Research, the global fem to cell market, which has grown to a market size of \$ 304800000 in 2013, it is expected to reach \$ 3.712 billion size of the market by 2020. This clearly shows the demand and the need for this technology. Managing such a large number of fem to cells must therefore be effective and efficient and, therefore, in this paper we propose a method that integrates EMS with end-to-end Fem to cell network to improve the management and performance of the system.

## II. LITERATURE SURVEY

In cellular networks, the estimated 60% of voice calls and more than 90% of data transmission services occur indoors. Many of these services, such as web surfing, downloading e-mails, video streaming and video calls require a high-speed connections and the growth of data traffic in the network. Customer expectations are rising, and soon mobile device must achieve the same bit rate as the current fixed Internet connection. [5]

However, many studies show that many mobile and Internet users at home and some medium-sized businesses are experiencing poor indoor coverage problem is primarily caused by the wall attenuation, multi-path loss, scattering, etc. Providing good indoor coverage in a cost effective manner, thus demanding challenge operators. The coating has always been an important issue in mobile communications networks. It has always been a problem in rural areas because of the large distances between base stations separate from the internal environment as described above. Various solutions have been adapted as a micronutrient, microcells and distributed antenna system (DAS), to overcome this problem by deploying them in hot spots in areas where there are problems of coverage and capacity in urban and rural areas. These solutions give rise to capital expenditures in the planning, creation of sites, the cost of equipment and expensive transit connections [6]. In addition, operating costs are significant due to equipment rental premises leased backhaul and increased electricity bills. This necessitated the birth of more compact and cost-effective technology - Fem to cells. They offer an entirely different approach to the existing problems of lack of indoor coverage and low data rates.

Fem to cells fully featured, with a range of small base stations of mobile phones that are used to complement the mobile phone services with the larger Macro cells towers. They range from very compact residential fem to cells for more equipment to be used in offices or public places. They offer excellent mobile communication and data transfer rates at all locations. Femto were designed for 3G, as well as newer 4G / LTE radio technology.

### III. DEFINITION OF A FEM TO CELL

Fem to cells, also known as a "home" base stations are small low-power cellular network access points that connect to the network device standard 3GPP mobile operator using residential subscriber line or last mile wireless technology. They allow users to access voice and broadband services on existing broadband connection to the Internet [8]. According to the UMTS architecture, Fem to cells are equivalent to UTRAN (RNC + Node B) in combination in the box. One residential fem to cells supports, usually not more than four to eight simultaneous connections in any room, allowing authorized users to connect to the fem to cells use multiple services such as voice, data, or real-time streaming multimedia, etc. [10]. The devices are integrated into a small plastic table working installation on a wall or instances and installed in the premises of customers by the customer. They are Plug and Play devices. Fem to cells have several advantages that make them become more and more popular in the world of wireless communications. Although there are some questions that will be processed, but still following advantages can be listed: a) compensates for poor cellular coverage within the home or small business. b) provides a plug and thereby providing the user with ease of installation and use. c)

Compact structure, that is, the fem to cell is actually the UTRAN in the box and offers all the services through existing broadband Internet access. d) voice and data calls through a protected thus IP-Sec tunnel encryption offers good quality and helps in providing data. e) help in unloading the macro traffic and cell phones automatically switches to the fem to cell coverage when in range. e) Fem to cells 3GPP compatible with all handheld devices and will help to increase the data rate and coverage in areas where there are slow speed and poor lighting. g) Femto can only operate effectively with existing network infrastructure by expanding cellular network, macro, but also can serve as the primary network, if enough fem to provided in the region, thereby reducing the number of macro cells reduce equipment cost and complexity

### IV. ELEMENT MANAGEMENT SYSTEM

The setup of Element Management System to manage a Fem to cell is as shown in Fig 1. EMS consists of node adapter, file Server, configuration server and Fem to cell (Node or Network Element) [1].

#### A. Provisioning tool

The work orders of a Fem to network, different profiles of a fem to, Fem to cluster and Fem to cell should be created or generated for a Fem to cell to be configured

#### B. Element Management System (EMS)

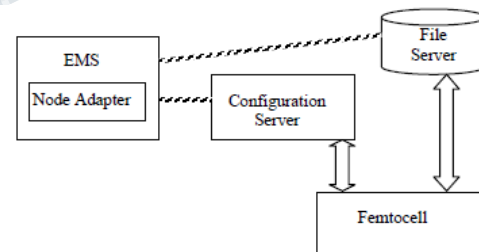
It is responsible for the management of all network elements in the management of the network, with the exception of fem to cells themselves; they are controlled jointly with the configuration server.

#### C. File Server (FS)

This gate is the central repository of files and software configuration for fem to cells. This is the main database from which Fem to cells upload your data provided by EMS

#### D. Configuration server

It is responsible for managing on fem to cells in conjunction with the EMS; Configuration Server controls the dynamic features of fem to cells (notified operator intervention, etc.), whereas EMS manages static and semi-static functions (configuration) and fem to cell periodically download information.



**Fig.1 Element Management System**

#### E. Fem to cells

A small base station, similar in size to a router and offer good signal coverage indoors. The fem to cell is located in the home network and the home network uses. The fem to cell service also allows direct access from the UE to the nodes on the home network.

#### F. Node Adapter

A node adapter at EMS manages Fem to devices. It is designed as java library to be integrated in the EMS. Node adapter will be in charge of: a) Receiving Fem to

registration notifications from configuration server b) Producing a initial Fem to configuration data file such as loading applicable profile and other configuration data and running auto-configuration algorithms to produce specific Fem to configuration c) Trigger the activation of this configuration file in the Fem to (through configuration server).

## **V. PROPOSED METHODOLOGY TO REGISTER A FEM TO CELL AND TO IDENTIFY BULK CM FILE STATUS**

### **A. Work order upload and Creation of Fem to Cluster**

A Provisioning tool is used to create the work orders for any network element. Work order is XML (extensible Markup Language) file, which contains the Fem to cluster Id, software version, geographical location, serial number etc of the fem to. After work order is created by the tool, it should be uploaded into Element Management System (EMS). Now, an entity called Fem to is created in the EMS. Once this is done, it means that Fem to is pre-provisioned. Then a Fem to cluster is created on EMS. That is an icon is created representing a mimic of fem to.

### **B. Send Registration events from Fem to Cell to configuration server**

To simulate the functionality of fem to, Customer Premise Equipment (CPE) simulator is used. CPE simulators consists of group of files, templates, scripts related to fem to. The CPE simulator and configuration server should be connected to send the registration requests. The simulator should know for which configuration server the request has to be sent. So, IP address of configuration server should be mentioned. Fem to has an unique serial number. By running the scripts using the serial number of fem to, from the simulator a request is sent to configuration server. The communication between simulator and configuration server is through TR-069 protocol.

### **C. Bulk CM File Creation, SFTP to File Server and to Fem to**

The configuration server will forward the registration request to the EMS. Now, EMS will first check whether the serial number of uploaded work order and the serial number of the Fem to that has to be registered is same, if it is matching, then other attributes like cluster Id, geographical location etc are checked. If all the information are mapped properly, EMS will create a Configuration Manager (CM) file i.e., bulk CM files which consists of work order information and Fem to specific information. Bulk CM file is also an XML file. This bulk CM file is transferred to file server using Secure File Transfer Protocol (SFTP). File server is a storage device where bulk CM files,

Fem to firmware etc can be stored. Now, EMS responds to configuration server conveying that Fem to is ready for activation process. That is, the EMS sends SFTP link to download the bulk CM files.

### **D. Fem to cell Activation**

The SFTP link will be sent to Fem to from the configuration server. The Fem to will now download the bulk CM files from the file server using the SFTP link. Only after downloading the bulk CM file, a Fem to will be activated on configuration server and a "Transfer complete" event is sent to EMS. In the device information tab, the complete details on Fem to is seen. That is serial number, IP address, activation status, last activation time etc.

### **E. Identification of the bulk CM file status**

After the Fem to registration process is completed as explained in previous section, a transfer complete event will be sent by Fem to device to EMS through configuration server. Once the Fem to downloads bulk CM file it will apply the file on itself. This action is similar to that of a simple software installation. Fem to starts applying the bulk CM file on itself, where it checks the status of the bulk CM file. A parameter called "DB state" is used to identify the status of bulk CM file. If there is a change in the DB state, a "StateChangeNotification" event is sent to EMS indicating the status. DB state includes the states of bulk CM file such as, download failed, invalid state, download timed out, etc. This can be viewed in EMS logs. The proposed methodology is to trigger the state change events from the Fem to device using simulators and verifying whether the events are received at EMS.

### **F. Transfer Complete Event**

This event is a method defined in TR-069 protocol. After a session is established between configuration server and Fem to cell, the requests and responses keeps exchanging between them periodically checking for the active session [2]. Only if the session is active any action can take place. Once the Fem to cell registration request have been sent to EMS, the node adapter code is responsible for processing the request and produce a bulk CM file. After the bulk CM file URL is sent back to Fem to cell, the downloading of bulk CM file starts. After downloading Fem to cell sends "Transfer complete" event which can be seen in EMS logs.

### **G. State Change Notification (SCN) Event**

The "state" is an attribute which is required to manage the Fem to cell effectively. Any change to the object performed is reported to the configuration server, to keep it synchronized with the Fem to device. State events are sent so that Fem to cell state can be reported to the EMS in form of state change notifications (SCN). The state

attributes here are availability state, administrative state and operational state and Data Base (DB) state. Availability and operational state are triggered from device internally. Administrative state change such as lock, unlock or shutdown are triggered from configuration server. DB states such as "invalid state", "download timeout", "download failed" etc are triggered from the bulk CM file to know its download status. This download status will be sent to EMS and can be seen in the logs of EMS.

## VI. PROTOCOLS USED

The communication protocols between Fem to cell and configuration server is TR-069. This protocol gives a secure auto-configuration and CPE management functions. EMS and configuration server communicate through SOAP/JMS messaging protocol. These are standard protocols used by web services. A network protocol SFTP is used by Fem to cell to FS which provides file transfer and management functions.

## CONCLUSION

A fem to cell is able to provide good access to a quality network of indoor users at a low cost while reducing the load on the entire system. For mobile operators, fem to cell attractions are improving both coverage and capacity, especially indoors. Consumers will benefit from improved coverage and potentially better voice quality and battery life. This paper is about using the EMS fem to cell registration and management, which is a major step leading to zero-touch initialization feature fem to cell and determine the status of the bulk CM file on EMS, which has a host adapter.

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