IoT·M2M Numbering Plan in Korea

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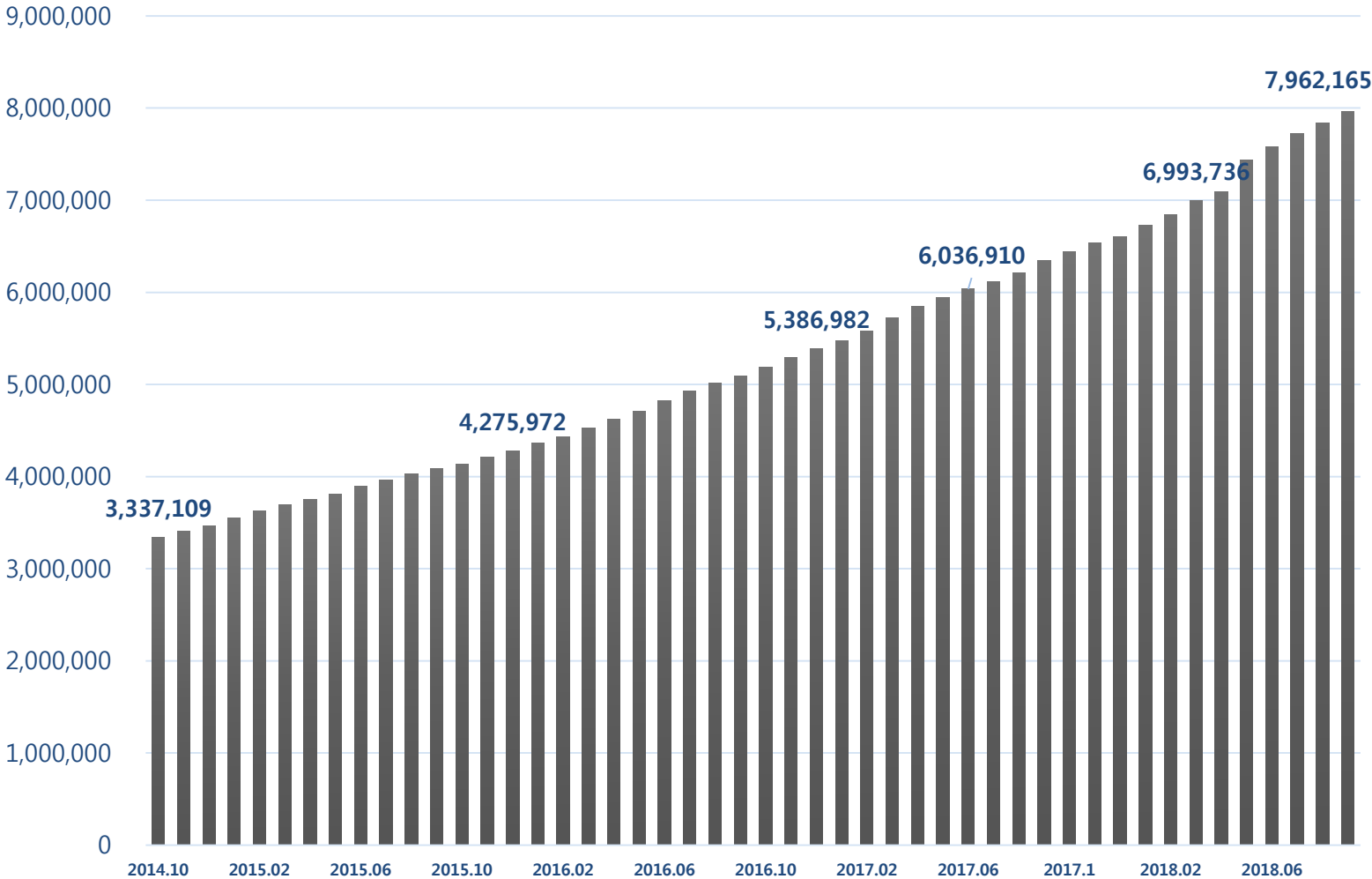**KISDI**
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ConTents

Cellular M2M Trend in Korea

Cellular M2M Trend in Korea

- As of Sep. 2018, cellular M2M records less than 8million lines

  - Machina Research estimation: 30million by 2023 (connections)
  - OVUM estimation: 10.16 million by 2022 (connections)

- No number issues for M2M devices connected via fixed-line network

  - IPv4 or IPv6 should be used as identifier

- M2M devices via mobile network demand numbers

  - LoRA device uses its own identification (Dev EUI by IEEE, LTID)

  - LTE-M & LTE NB-IoT devices use USIM ▶ IMSI (E.212)

Recalling the Recommendation of ECC

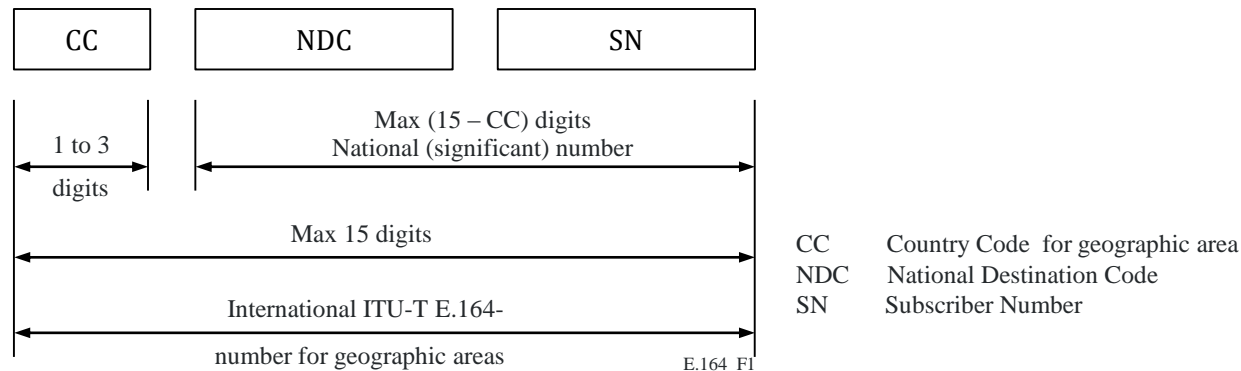- Revisiting the recommendations of ECC in 2010 & 2011:

  In the long-term, IPv6 should become an alternative numbering resource for M2M applications

  In the short to medium term, a combination of the following could be an option:

  1. Use existing mobile number ranges

  2. Use a new number range

  3. Use an international numbering solution; or

  4. Use network internal numbers

M2M numbering plan in Korea

- Options 1 & 2 were mainly considered to secure M2M number resource

- Option 1 : use mobile number range

  - Mobile number follows E.164 numbering system
  - Possibility of exhaustion of number range (around 90% was used)
  - Extension of mobile number range was not a feasible option

    • Extension of IMSI was not feasible although MSISDN might be feasible (but costly)

CC	NDC	SN

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1 to 3          Max (15 – CC) digits
digits          National (significant) number

        Max 15 digits

        International ITU-T E.164-
        number for geographic areas          E.164_F1
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CC   Country Code for geographic area
NDC   National Destination Code
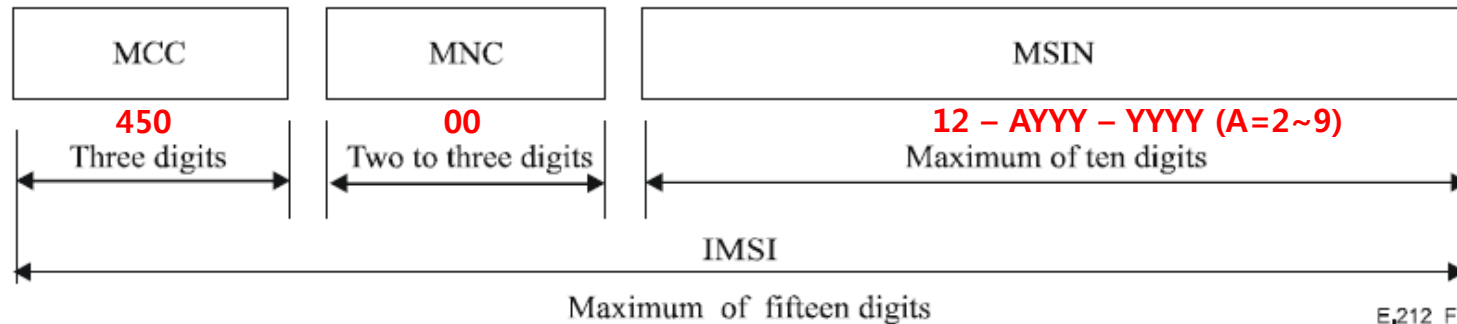SN   Subscriber Number

M2M numbering plan in Korea

- Option 2 : use new number range

  - Number range used for pager was available for new assignment

  - Number portability was not a significant concern

  - Devices supporting voice call & SMS
      → use mobile phone number range

  - Some services had already been using mobile numbers

    e.g., Telematics, Wireless Router, etc.

  - Mobile number unification policy shall bring more freedom for

    future use of numbers (01X numbers → 010)

Numbering for Cellular M2M in Korea

- In 2013 Feb., MSIP(MSIT) of Korea decided to introduce a new number range for M2M devices

	0	1	2	3	4	5	6	7	8	9
01Y	3G/4G	2G	**M2M**				2G	2G	2G	

MCC	MNC	MSIN
450	**00**	**12 – AYYY – YYYY (A=2~9)**
Three digits	Two to three digits	Maximum of ten digits

IMSI

Maximum of fifteen digits

E.212_F1

MCC   Mobile Country Code
MNC   Mobile Network Code
MSIN   Mobile Subscription Identification Number
IMSI   International Mobile Subscription Identity

- MSIT may allocate up to 10^5 numbers (or less) for each application

Numbering for Cellular M2M in Korea

- Introducing new number range secured 80 million numbers for M2M use

- Devices supporting voice calls (e.g., smart watch or tablets) may be assigned with existing mobile phone number

- As of Dec. '17, 13.8% of total numbers was allotted to Telcos, and only 6.3% has been actually used

- In the short-run, we do not expect a shortage of numbers for M2M and expect to collect the numbers used for 2G

- However, forecasting for M2M number demand is still important for decision of policy direction

Forecasting for IoT M2M number demand

- The number of M2M devices are monthly reported with 6 classifications and this produces 6 possibly correlated time series

- Thus various time series analysis can be used for forecasting

- For a short-run, VAR model and for long-run, VECM can be used

  VAR(p): $$X_t = C + \Theta_1 X_{t-1} + \cdots + \Theta_p X_{t-p} + \varepsilon_t = C + \Sigma_{i=1}^{p} \Theta_i X_{t-i} + \varepsilon_t$$
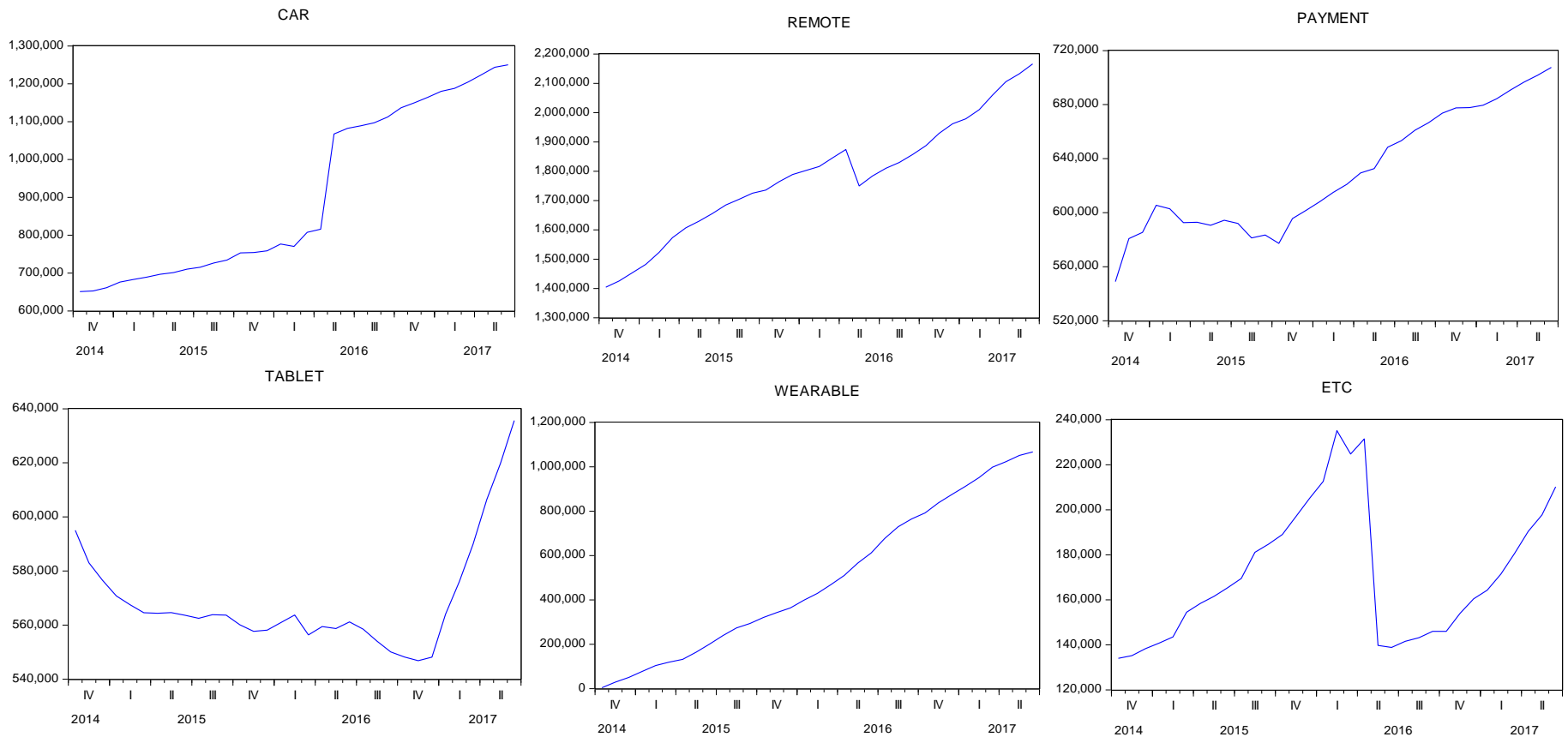
  i) $E(X_t) = \mu < \infty$
  ii) $Var(X_t) = E[(X_t - \mu)(X_t - \mu)'] = \Sigma_X < \infty$
  iii) $Cov(X_t, X_{t+k}) = E[(X_t - \mu)(X_{t+k} - \mu)'] = T_X(k)$

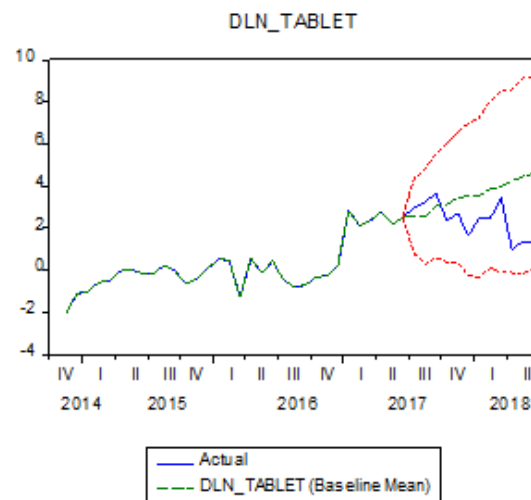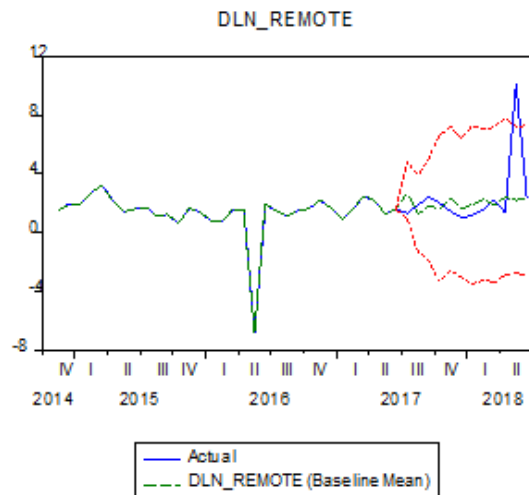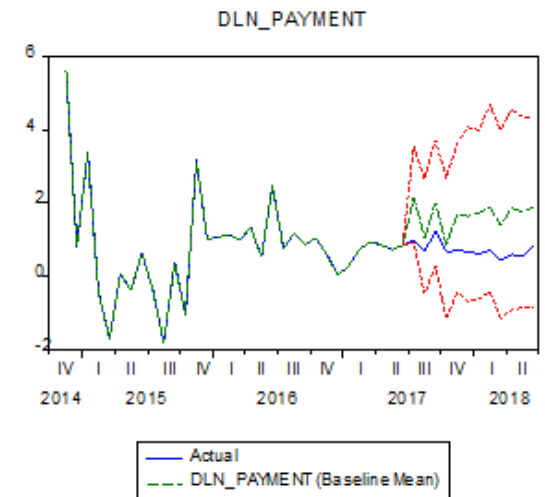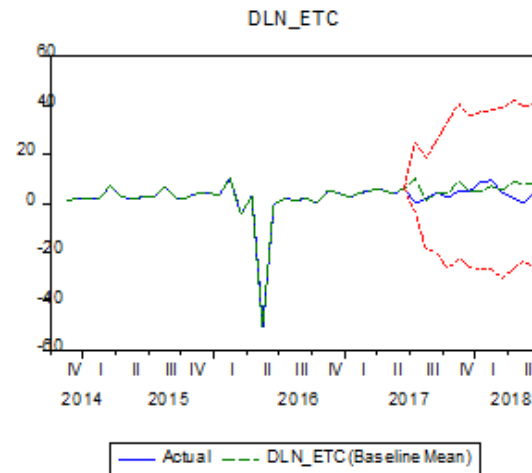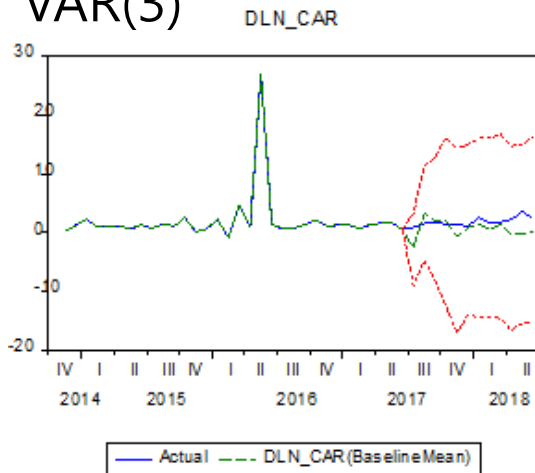- Bass type models –esp. Bayesian Bass - can also be considered

Forecasting for IoT M2M number demand

- All series need to satisfy technical assumptions (stationary cond.)
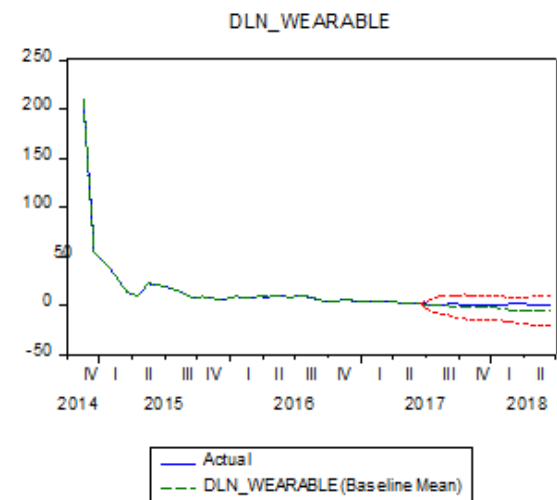
VAR(3)

Forecasting for IoT M2M number demand

- Appropriate VAR(3) model produced good in-sample forecasting results for 5 series while 1 (remote) exhibited high variation

- The study suggests that VAR model would be a good indication for short-term forecasting(a year-long); however, forecasting-error might become significantly large for highly volatile series

- MSIT closely monitors the available number resources for M2M and the forecasting exercises would be extended for more precision

Thank you