Efficient Administration of Swedish E.212 MNCs and Related Demands

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Agenda

- Background
- Technical Analysis
- Business Analysis
- Conclusions
- Recommendations

Study ordered by Post- och Telestyrelsen (PTS)

High Level Scope:

"Call-off request for study on efficient management and use, as well as an overall needs picture with appropriate solutions, of E.212 MNCs for current and future different applications for public and private electronic communications networks."

Initial Narrowed Scope:

- How can an effective allocation/use and management be made to meet these needs:
  - Is it technically possible that two-digit MNC spaces like 80-99 can be converted to three-digit codes. If that is not possible, clearly present what prevents this.
  - What other solutions are there for the efficient assignment of MNCs, and what management is required for these. Are there any implications for the current handling of MNCs 65-66. A new approach shall be proposed based on these conditions.
- How can the needs of own E.212 MNCs, primarily for private networks, be quantified.

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Methodology

Questionnaires (coordinated with PTS), sent to different categories of actors

Two main areas:

- Technical conditions and challenges
- Market demands for MNCs

Actor Categories:

- Mobile System Providers
- NRAs/NPAs
- MNOs and Service Providers
- Neutral Host Network Providers

Very limited input on NPN market growth due to competition reasons

Limited input from MNOs and SPs

NRA/NPA and NHN contributions very valuable

The Mobile System Providers (Ericsson, Nokia) very resource constrained, resulted in other types of input. Critical contributions to main conclusions and related revisions.

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Erik Hedin, Ericsson

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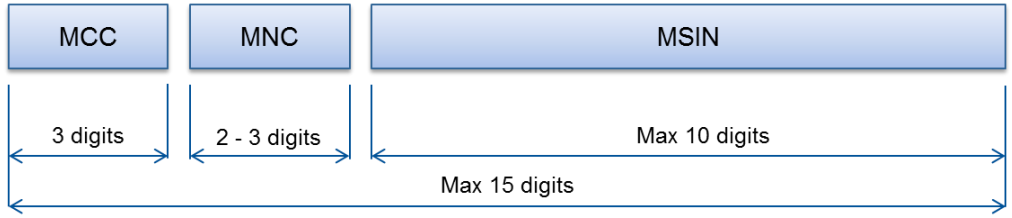
E.212 MNC – Main Topic

International Mobile Subscriber Identity (IMSI)



MCC: Mobile Country Code

MNC: Mobile Network Code

MSIN: Mobile Subscription Identification Number

PLMN ID = MCC + MNC

A traditional PLMN has a unique MNC / PLMN ID

Unique MNCs for Private Networks / Non Public Networks (NPNs) shall be avoided as far as possible due to the large numbers expected

NPN options:

- Global MCC 999 dedicated for NPNs on an international basis
  - Uncoordinated i.e. NPNs can apply any MNC without any external (regulator etc) coordination.
  - Both 2- and 3-digit MNCs can be used, MNCs 99/999 for testing
- Geographical/National uncoordinated MNCs
  - Sweden: MNCs 65 and 66. MNCs 67-68 for testing
- Geographical/National coordinated shared MNCs
  - MSIN divided into "sub-networks" assigned to NPNs
  - Coordinated by NPA/NRA – Germany, Norway
  - Also organisations:
    CBRS – uses US MNC
    MulteFire Alliance – uses global MCC 902

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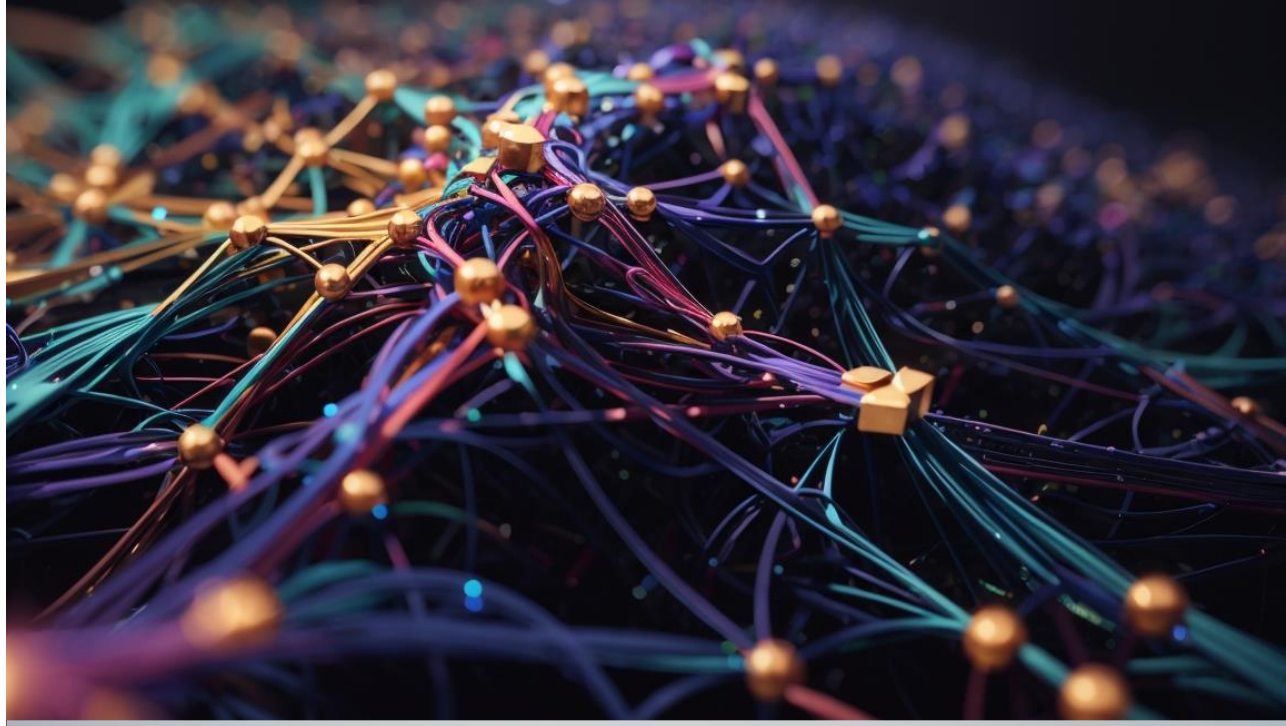
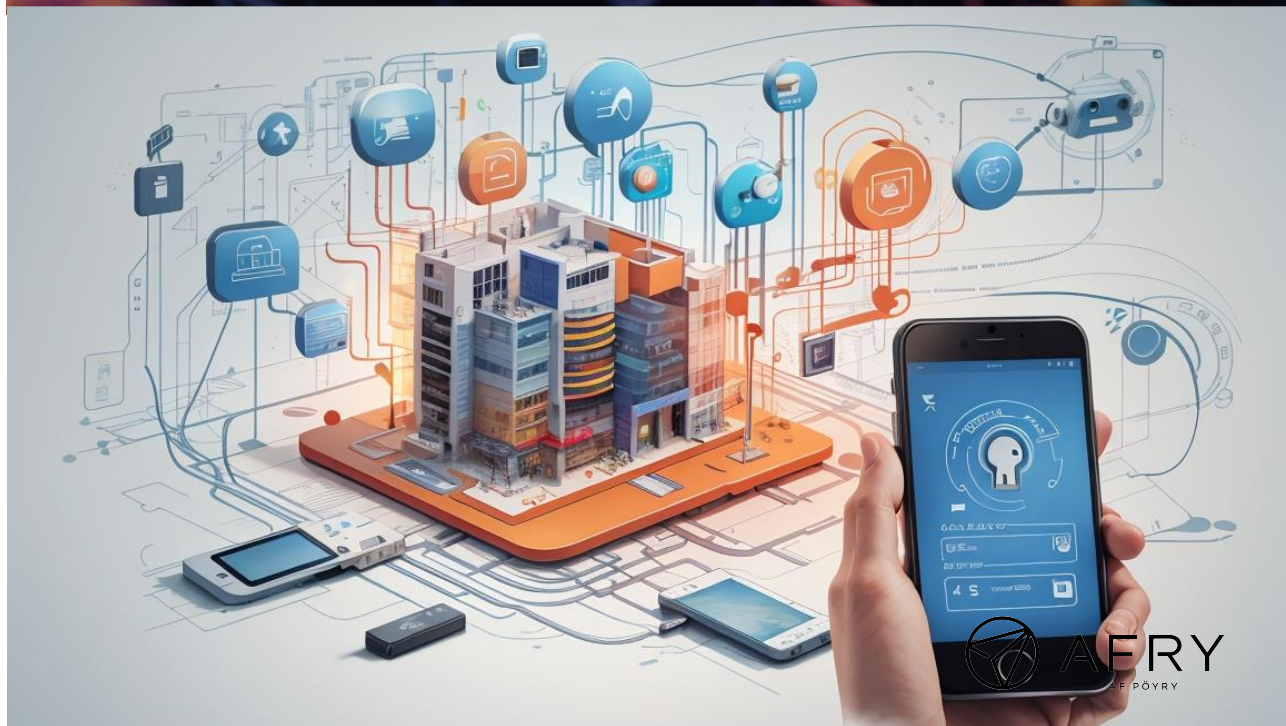
Technical Analysis

How can MNCs be as efficiently administrated as possible?

- To what extent is it possible to introduce 3-digit MNCs for the 8x and 9x MNC series under present MCC 240
- How shall un-coordinated vs shared MNCs be handled
- Roaming considerations for SNPNs





2- and 3-digit MNC Mix – Possible?

Background:

If applying 3-digit MNCs for the Swedish 8xx and 9xx the number of MNCs will increase from 20 to 200.

The issue is that 3GPP specification TS 23.003 state that a mix is not recommended. However, the 3GPP positioning was set a long time ago, and reality has changed since then.

The question is whether the 3GPP positioning is still valid or not, and what would be the concrete considerations for one or the other.

YES!

The answer is that **a mix is possible!**

- The 3GPP specifications clearly defines how to separate between 2- and 3- digit MNCs end2end
  - Confirmed by Nokia and Ericsson
- Overlapping MNC series shall be avoided, e.g. if MNC 75 is assigned, the whole 7xx series is not applicable for 3-digit MNCs
- This was already concluded by T-mobile (NL) in 2012. T-mobile has confirmed that this is also their current view.
- The 3GPP response to ITU-T SG2 in 2012 also relates the problem with a mix to *"if there is an overlap of 2-digit and 3-digit MNC allocation plans in a given MCC"*
- India has applied 2- and 3-digit mix for a long time, prior to 2013. No reported problems incl. routing.
- In 2018 France introduced 3-digit MNCs for NPNs and Broadband Internet Access respectively. No problems have arisen since that.

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Which SNPN MNC Direction?

Global
MCC 999 MNCs
Uncoordinated

National
Shared MNCs
Coordinated

National
MNCs
Uncoordinated

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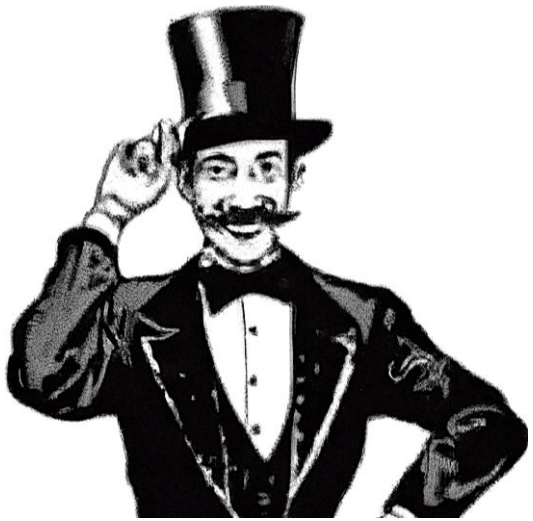
The Future SNPN MNC Road



Mr. C. Holder
“The Broker”

Critical Technical Items

NPN Device Support

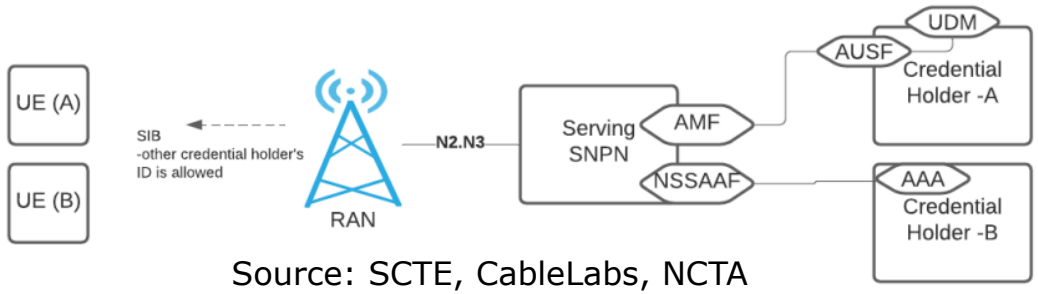
- Apple Announcement June 2023 (iOS 17)
- NPN Feature Support 4G and 5G (no voice)
- Global MCC 999
- Sweden: MNC 60 (VGR) withdrawn
  Added MNCs 41 and 49
  Probable future support for 65 and 66

Unique SNPN Network ID

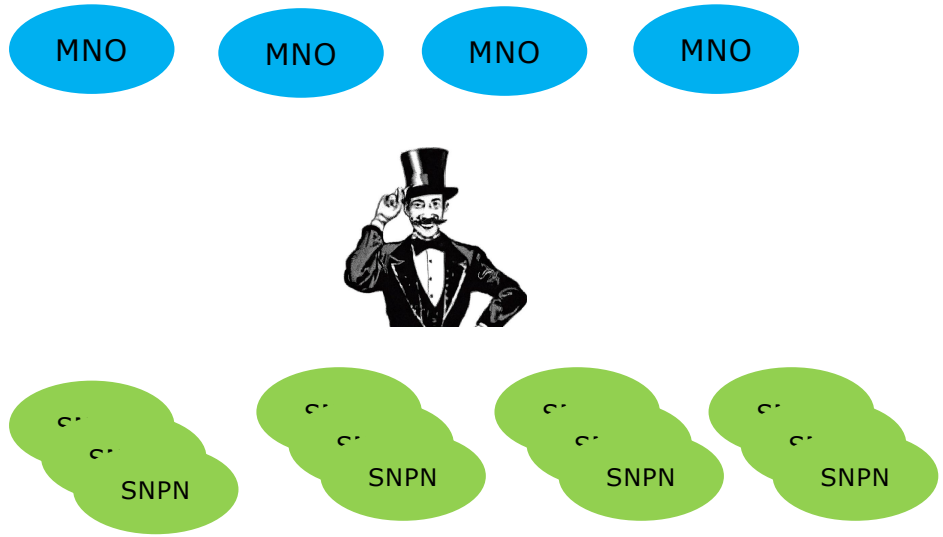
- SNPN ID = PLMN ID + **5GC-NID**
- IANA PEN alternative => Self administration
- Shared MNCs ruled out

Future SNPN Concepts

- Credentials Holder – "Home Authentication"
- Broker role essential
- Localized Services
- Onboarding – SNPN subscription



Source: SCTE, CableLabs, NCTA



Note: MNOs and SNPNs could also take the CH role

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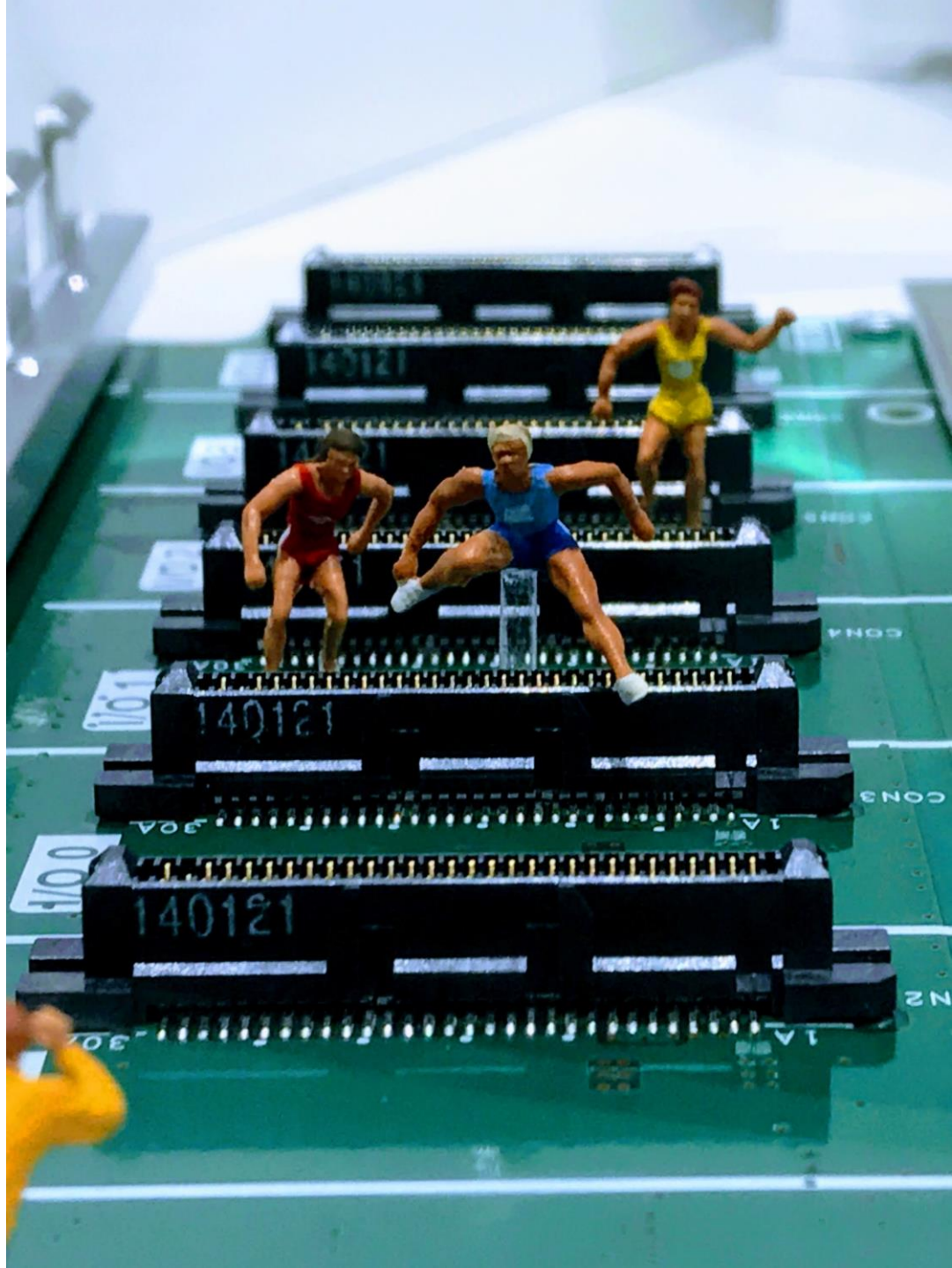
5G vs 4G Considerations

It will take a number of years until 4G is phased out for SNPNs (and cannot be started until late 2025 due to 5GC-NID availability)

During the migration period, specific actions are required to avoid “MNC interference” as covered by the report.

Global MCC 999 with almost 1000 MNCs is well suited for minimizing “MNC interference” risks



Roaming Considerations

Roaming is not supported for SNPNs by 3GPP.

How to avoid that dedicated MNCs are requested for pure roaming reasons?

The future CH concept could be seen as a “roaming substitute”, however limited to authentication.

Limited 3GPP work to conclude specifications on how to support SNPN roaming.

Thus, there is a motivation to urge 3GPP to define the SNPN roaming support.

In any event, both CH and potential SNPN roaming are far away in time.

Thus, near term alternatives must be sought.

Ericsson has presented a new role being established. Major M(V)NOs with many roaming agreements, offer a service for international SNPNs roaming. The SNPNs will utilize a specific part of the M(V)NO IMSI range, as for shared networks.

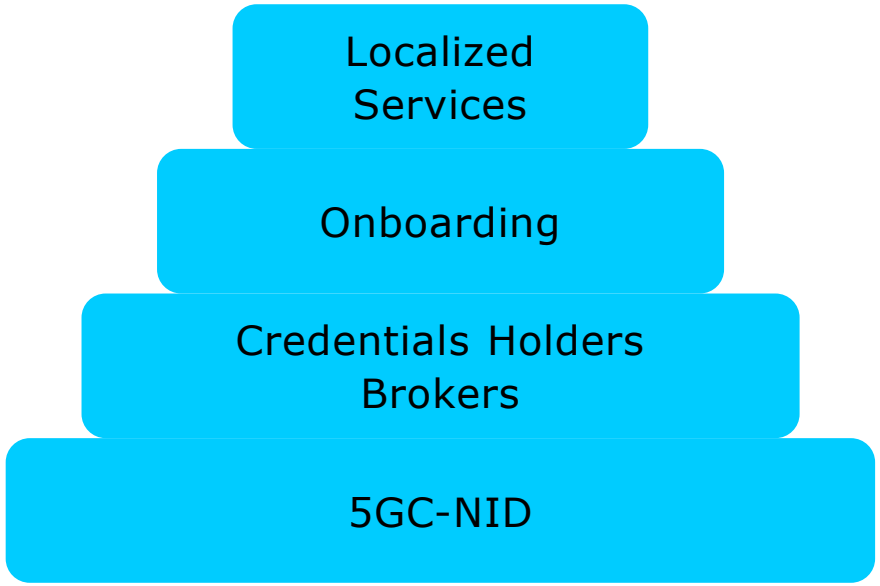
This type of service could also be applicable for the Swedish market. Since it is very MNC effective, this is something to be promoted.

Business Analysis – MNC Demands

- No concrete input received on MNC demands
- Only SNPNs were addressed as drivers for MNC demands
- Neutral Host Networks were specifically addressed in the questionnaires, but responses did not reveal any real needs for own MNCs
- No concrete information on SNPN market volumes were received
- Some very loose market estimations are presented in the report

Conclusions – Technical Analysis

- No technical "blockers" for 2/3-digit MNC mix, non-overlapping MNC series
- Uncoordinated MNCs, best MNC administration direction
  - Global MCC 999 has iOS support, and Swedish MNCs 65, 66 might obtain similar device support
  - 5GC-NID self administrated – no PTS handling required
  - No need for a coordinated approach
  - Shared MNCs will not scale as good as 5GC-NID
- Migration Period Towards 5G Only with 5GC-NID
  - MNC Interference to be limited – MCC 999 best option
- Key Future Components for SNPNs
  - 5GC-NID for unique SNPN Identification (SNPN IDs)
  - Credentials Holders and Associated Brokers
  - Onboarding – SNPN Subscription
  - Localized Services
- SNPN roaming not supported by 3GPP
  - Long term
    - 3GPP standardization to be sought
    - CH "Roaming Substitute"
  - Short term
    - Specific roaming services



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Conclusions – MNC Demands

- SNPNs - today the only identified driver for MNC demands
- Roaming is a critical aspect
  - Drives needs for own MNCs
  - Short and long term alternatives as presented in previous slide
  - 5GC-NID will be a critical component
- No specific demands for NHNs

Recommendations – Effective MNC Management

- Assign non-overlapping 3-digit MNC series as far as possible
  - Involves 7xx, 8xx, 9xx series
  - PTS free to select how to split applications/usage between the series
- Continue with the un-coordinated MNC approach, without allocating new national MNCs
  - Global MCC 999 main path with most MNC options, and Apple support, to be promoted by PTS
    - Make market aware of that MNCs shall be spread out etc (and how to prepare for 5GC-NID)
    - System/solution providers will play a vital role when initiating new systems
    - SNPN owners will administrate 5GC-NIDs themselves
  - MNCs 65-66 to continue as common un-coordinated MNCs
    - Will compete with global MCC 999 MNCs, the latter allows for easier administration related to “MNC Interference”
    - It is expected that MCC 999 will be a starting point for device support, and that other national MNCs will follow (if supported)
    - The question is then what will be drivers for selecting MNCs 65-66 vs. MCC 999
- Limit assignments of own MNCs for SNPNs due to roaming needs
  - Direct applicants to market players offering SNPN roaming (using M(V)NO IMSI ranges)
  - Promote new (local) offerings of SNPN roaming to be established
  - Push for technical SNPN roaming support in 3GPP specifications
  - Follow the future evolution of the CH concept and how it can function as a roaming substitute
  - Potentially, promote the “CH Broker” role and stimulate/promote MNO participation

Recommendations - PTS Actions

- Reallocate MNC 8xx and 9xx series
- Communicate that 3GPP shall remove the 2/3 digit mix limitations
  - CEPT, ITU - Liaison Statements => 3GPP
  - Swedish Numbering Forum => Swedish MNOs => 3GPP
  - Mobile System Providers (Ericsson, Nokia …) => 3GPP
- Communicate that 3GPP should standardize SNPN roaming
  - As above
- Establish Swedish NPN/NHN Forum
  - Primarily to be led by PTS, but other options could be applicable
  - CEPT: *"NPAs may consider encouraging industry stakeholders to lead on a national coordination regarding the use of MNCs under MCC 999"*
  - Establishment of SNPN usage guidelines
    - MNC coordination, within MCC 999 and MNCs 65-66
  - Handling of 3GPP items above
  - Timing knowledge sharing (5GC-NID, CH ….)
  - Follow and stimulate/promote roaming services and CH establishment
  - Stimulate NHN adoption (5G Small Cell Technology)


Making Future