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Industry presentation for NPT (including amendments)

2013 update of NPT's mobile LRIC model

1 March 2013 • Ian Streule, Matthew Starling, Alex Slinger, Alex Reichl

Alterations to the slides presented

- Following the industry meeting on February 21 2013, a number of amendments have been made to the slides
  - these are highlighted with the label ”amended” in red text

- The calibration and reconciliation of the actual operator calculations have been further refined since the industry meeting, and the indicative charts at the end of the presentation for the generic operator have been updated to reflect the v8D model issued for consultation

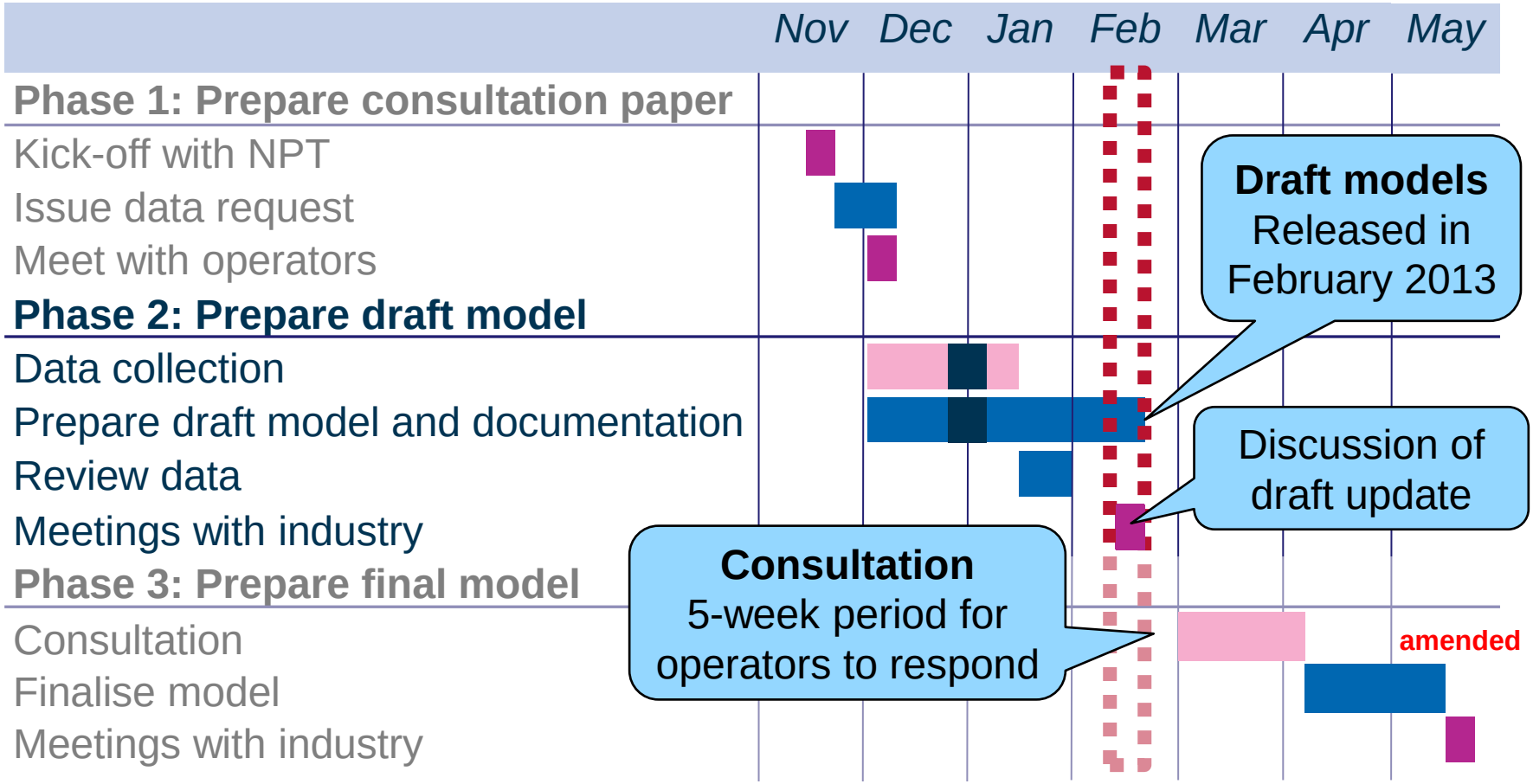
Confidentiality notice

Contents

Introduction

- Analysys Mason Limited ('Analysys Mason') has been commissioned to assist the Norwegian Post and Telecommunications Authority ('NPT') in updating the existing long-run incremental cost (LRIC) model for mobile networks in Norway
- The original LRIC model was released in 2006, the most recent update of this model was in 2010 (developed in both cases by Analysys Mason)
  - we will refer to the 2010 version of this model as the "v7.1" model
- The updated version of this LRIC model will help inform future NPT decisions on the pricing of regulated mobile services after the current regulation ends in 2013
  - we will refer to the draft updated model as the "v8D" model

Update on project status: Currently finalising the draft model for Phase 2



KEY:

- Model development
- Operator consultation period
- Industry meetings/workshops
- Holiday periods

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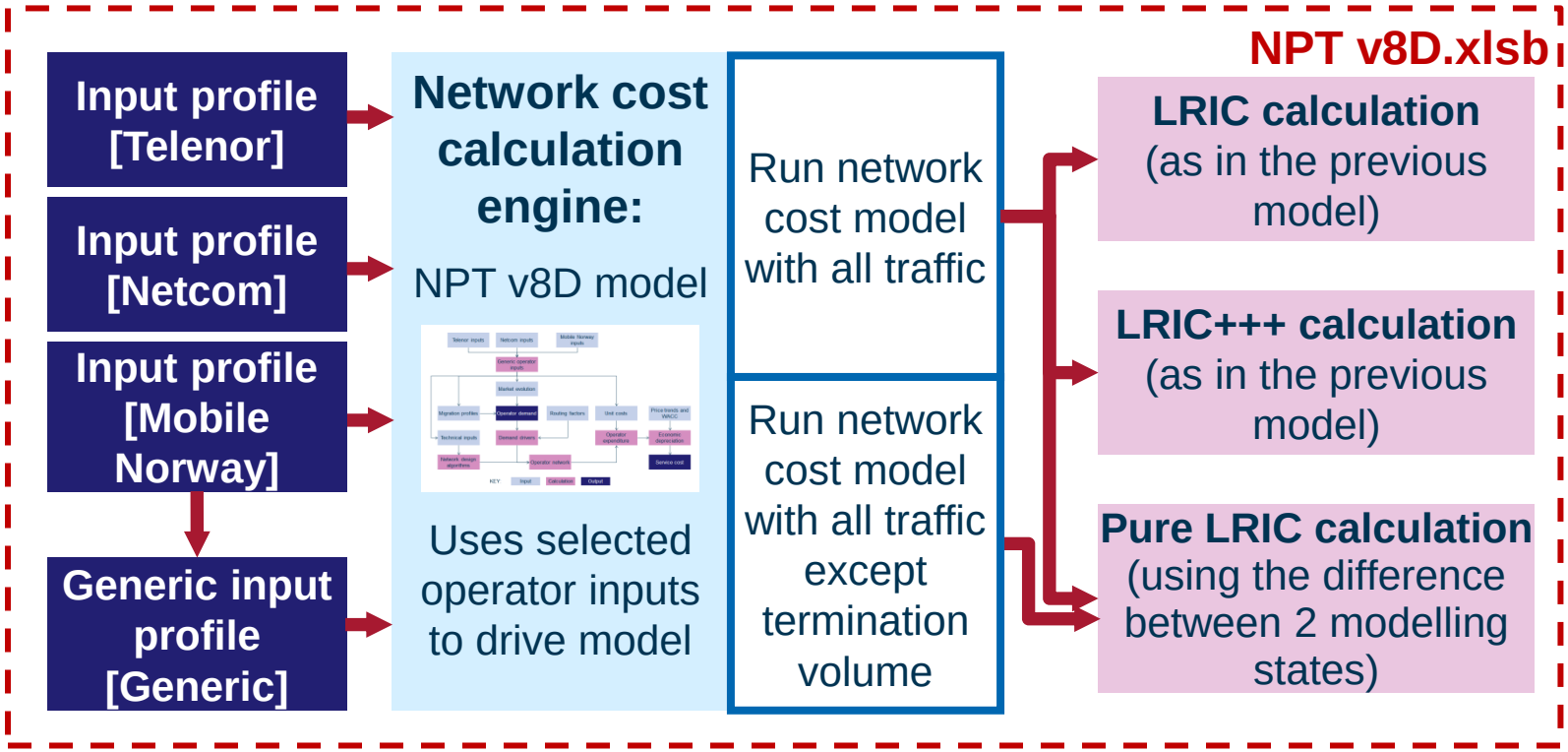
The draft model (v8D) will be released to NPT

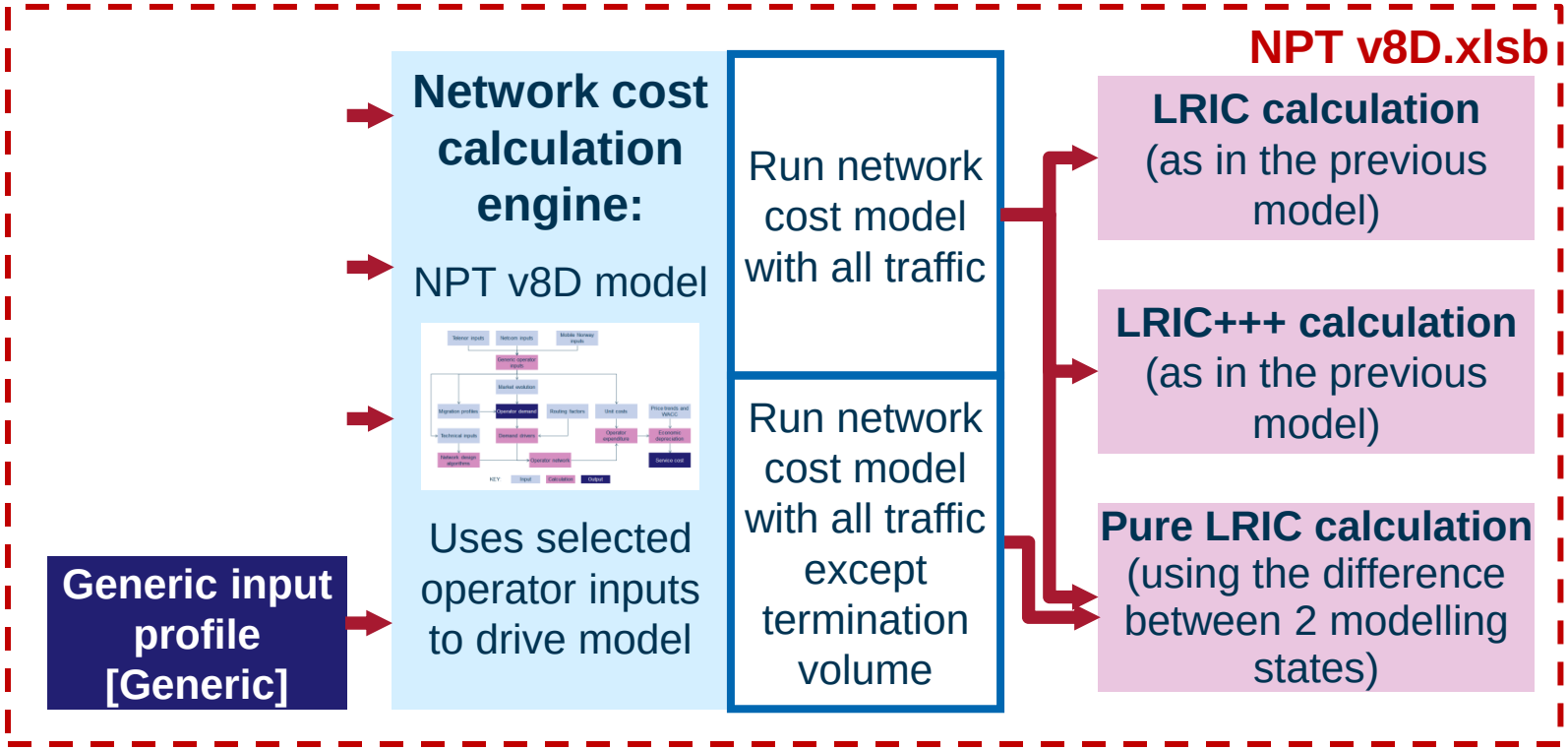
Illustration of materials available to NPT



Source: Analysys Mason

A (redacted) public version will also be made available on www.npt.no

Illustration of materials published by NPT



Source: Analysys Mason

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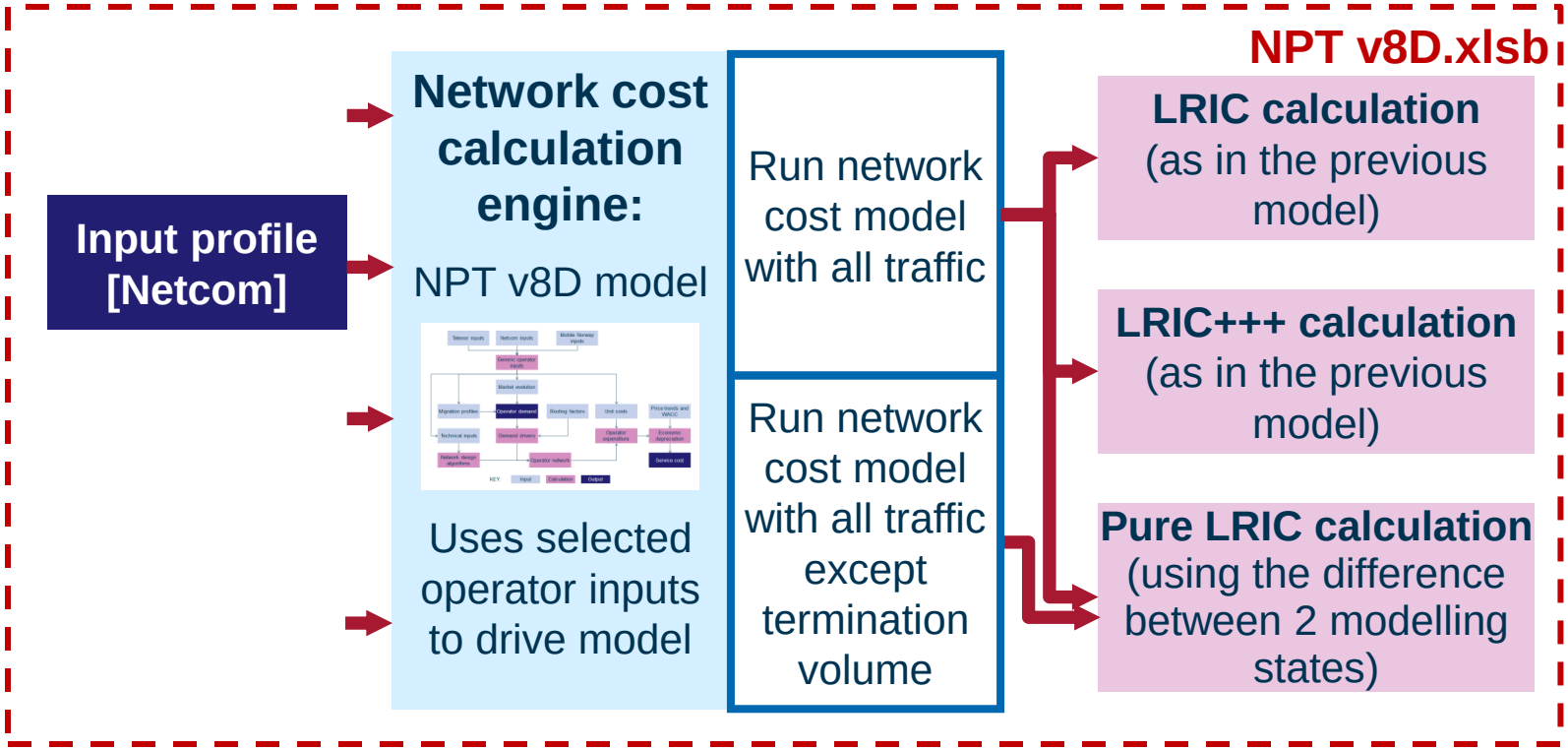
The mobile operators will each receive their own redacted material

Illustration of materials released to an operator (Netcom shown)



Source: Analysys Mason

Contents

Some of the model concepts require revision or rewording [1/2]

Conceptual issue	Recommendation from the v6 LRIC model
[1] Structural implementation	Bottom-up, reconciled against top-down information
[2] Type of operator	Actual operators with a hypothetical third network operator
[3] Size of operator	Actual size of operators with a hypothetical third network operator
[4] Radio technology standards	2G and 3G, as needed to reflect actual operators
[5] Treatment of technology generations	Included within the model explicitly
[6] Extension and quality of coverage	Reflect historical and expected future coverage
[7] Transmission network	Actual transmission networks as far as possible

amended

Source: NPT concept paper, December 2009

Some of the model concepts require revision or rewording [2/2]

Conceptual issue	Recommendation from the v6 LRIC model
[8] Network nodes	Apply scorched node, optimised for efficiency
[9] Input costs	Mixed approach based on actual/average costs
[10] Spectrum situation	Include capability to capture actual or hypothetical allocations, as well as licence fees
[11] Service set	Both voice services and non-voice services
[12] Wholesale or retail	Apply a 75:25 split of overhead costs
[13] WACC	Update the WACC value
[14] Depreciation method	Economic depreciation
[15] Increments	Calculate LRIC, Pure LRIC and LRIC +++ costs
[16] Years of results	All relevant past and future years (i.e. from 1992)
[17] Mark-up mechanism	Equi-proportionate mark-up (EPMU)

Source: NPT concept paper, December 2009

Some concepts require rewording to take into account the change in modelled operators

- For concepts 1, 2, 3 and 6, the v7.1 concept paper refers to "2 actual operators and a hypothetical third operator"
  - the v8D concepts have been adjusted to refer to "3 actual operators and a generic efficient operator"
- Concept 8 has been clarified in the context of the generic operator
- Particular generic operator* inputs have been defined using the values of the actual operators
  - these values were derived using the scorched-node principle
  - the generic operator therefore implicitly reflects the scorched-node principle
    - i.e. we are not using a scorched-earth approach

*Examples include cell radii for coverage sites, cell radii for in-fill sites, number of switching locations

Concepts 4/5 have been revisited to consider whether the v8D LRIC model captures LTE

- At the current time and given the current focus of the model on voice termination, it has been decided not to model LTE explicitly
- In particular, key aspects of LTE network deployment remain uncertain:
  - the long-term extent of the networks (national or only urban?)
  - the relevant spectrum allocations
  - the extent of infrastructure sharing between operators
- The model developed by the Swedish regulator indicates that assuming an urban LTE network in Sweden alongside 2G/3G networks leads to only a few percent reduction in the LRIC+++ and negligible change to the pure LRIC
- The v8D model approach considers 3G technology in perpetuity, with 2G being shut down in 2020

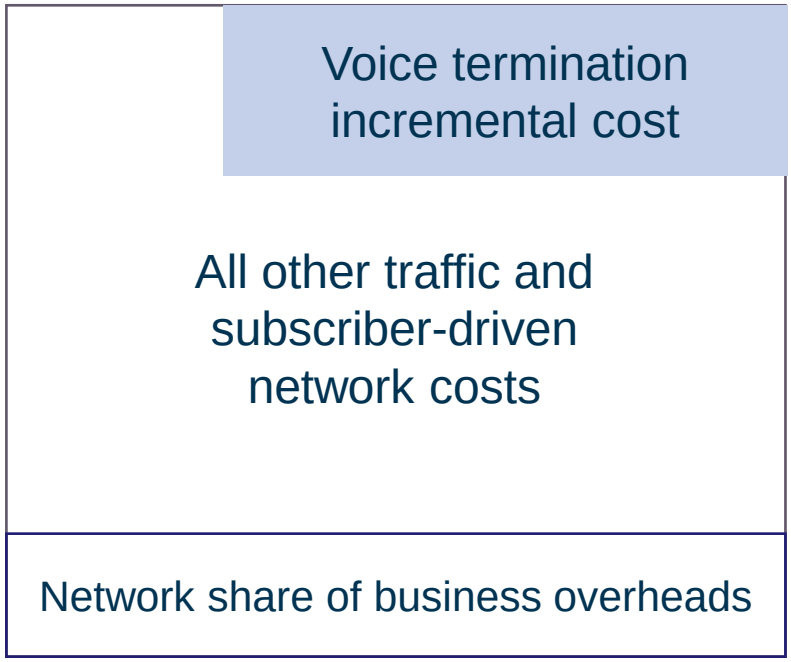
amended

Concepts 10/11 have been revised to reflect changes in spectrum and the service set

- Concept 10 does not refer to using generic spectrum allocations in the v7.1 paper
  - this has been revised
- The v7.1 concept also does not explicitly refer to the treatment of future licence renewals
  - this is relevant given the large amount of spectrum that is coming up for renewal
  - our position is to retain the current implementation of renewals*, and thus to say nothing in advance of the event
- Concept 11 from the NPT v7.1 paper refers only to conventional GSM/UMTS services
- The concept has been reworded for the NPT v8D model to indicate that the model is also going to forecast the following services:
  - LTE data megabytes
  - Over-the-top (OTT) variants of voice and SMS services

** Namely, that licences are renewed periodically, with the value increasing only with inflation*

Concept 15 has been reworded to bring more clarity to our Pure LRIC approach



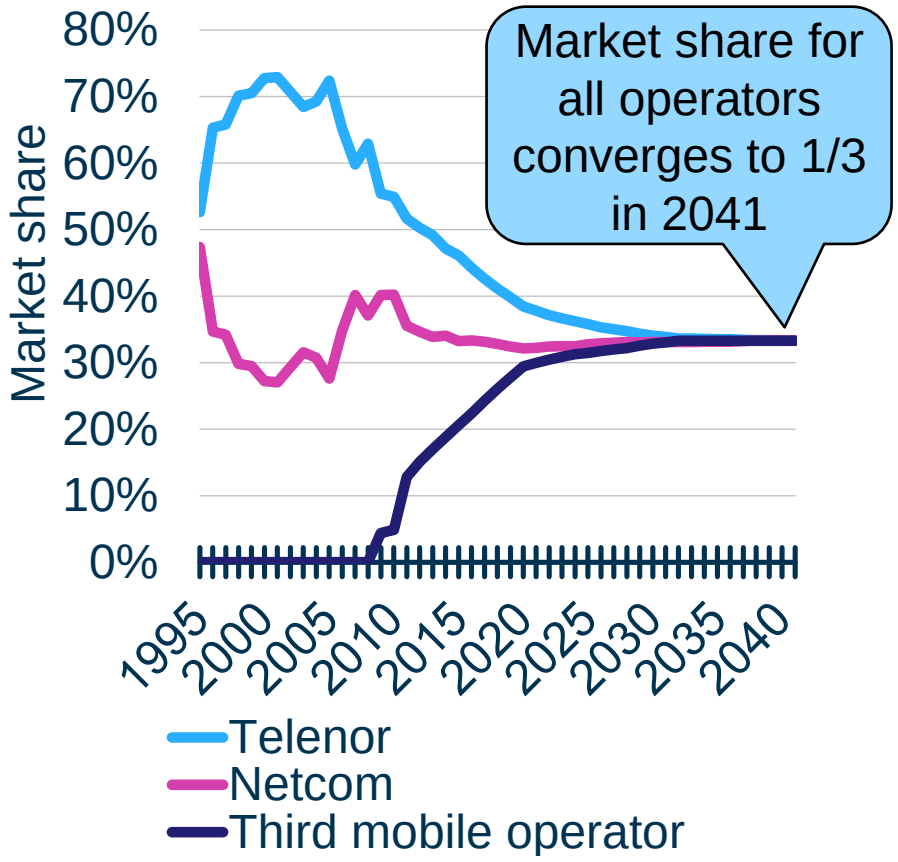
- The Pure LRIC approach in the v7.1 model was based on the draft EC Recommendation, that specifies
  - only the cost '*which is avoided when not offering voice termination*' should be allocated to this service
- We have focused our v8D Pure LRIC modelling on an approach that
  - includes network adjustments
  - calculates the avoided expenditures and then applies economic depreciation

Source: Analysys Mason

The model issued in September 2010 was the starting point for this update …

- The v4 model was released in 2006
- Particular inputs within the model have then been updated regularly
- The last update was completed in September 2010 (the v7.1 model)
  - a hypothetical third operator was added to this model
  - the market share was forecast as a slow move to three operators of equal scale

Market share forecast from the v7.1 update



Source: NPT v7.1 model

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… including updates for operators' historical and forecast data

- Some long-term demand forecast endpoints were revised for the v8D model
  - these are highlighted in red opposite
- Other inputs remain in line with those in the v7.1 model

Long-term demand forecasts

Service	v8D monthly forecast*
Mobile penetration	115 %
Originated voice	From 240 to 190 minutes/sub
Incoming voice	From 125 to 110 minutes/sub
Incoming SMS	50 SMS/sub
Outgoing SMS	70 SMS/sub
Low-speed data usage	From 10MB/sub to 100 MB/sub
High-speed data usage	From 1000MB/sub to 1400 MB/sub

* *minutes/sub = minutes per subscriber*
SMS/sub = messages per subscriber
MB/sub = megabytes per subscriber

Source: NPT v7.1 / v8D models

The Market module has been updated using various sources

- Total market demand is based on available figures from a number of sources:
  - NPT data
  - other publicly available datasets
  - data requested from the operators
- These input/data revisions to the market calculation have led to updated demand forecasts for the v8D model

The third operator demand has been replaced

- In the market forecast for the v7.1 model, we explicitly dimensioned the network of a third mobile operator, referred to as the "Third operator"
  - this was set up using assumptions distanced from operator data
  - this calculation was then distributed to all mobile network operators
- In the v8D model, this has been replaced with two new calculations:
  - a [operator-confidential] calculation of the demand carried by the Mobile Norway network
  - a [public] calculation of the demand carried by a **generic operator** (as described later in detail)

We updated the demand data for the years 2009–12 to accommodate historical data

- The worksheet for the demand data in the v7.1 model was *D3_M6*
  - a copy of this worksheet (*D3_M8*) has been updated in order to align demand inputs (mainly for Telenor, NetCom and Mobile Norway) with the NPT market data

amended

- Using the NPT market data and operator responses to the data request for the years 2009–12, we calculated traffic and subscribers by host network i.e. Telenor, NetCom, Mobile Norway
  - these values were then incorporated into *D3_M8*

We updated the following voice traffic inputs in the years 2009–12 …

Input	Operators updated	Comments
Digital mobile penetration	Total mobile market	NPT market data used
Market share of high-speed subscriptions by operator	All operators	NPT market data used
Mobile broadband penetration	Total mobile market	NPT market data used
Market share by operator	All operators	NPT market data used
Outgoing voice minutes per subscriber per month	All operators	NPT market data used
On-net minute proportion	All MNOs	NPT market data used
Incoming voice traffic	All MNOs	Both operator data and NPT market data used

Source: Analysys Mason

… as well as the following SMS/data traffic inputs in the same period

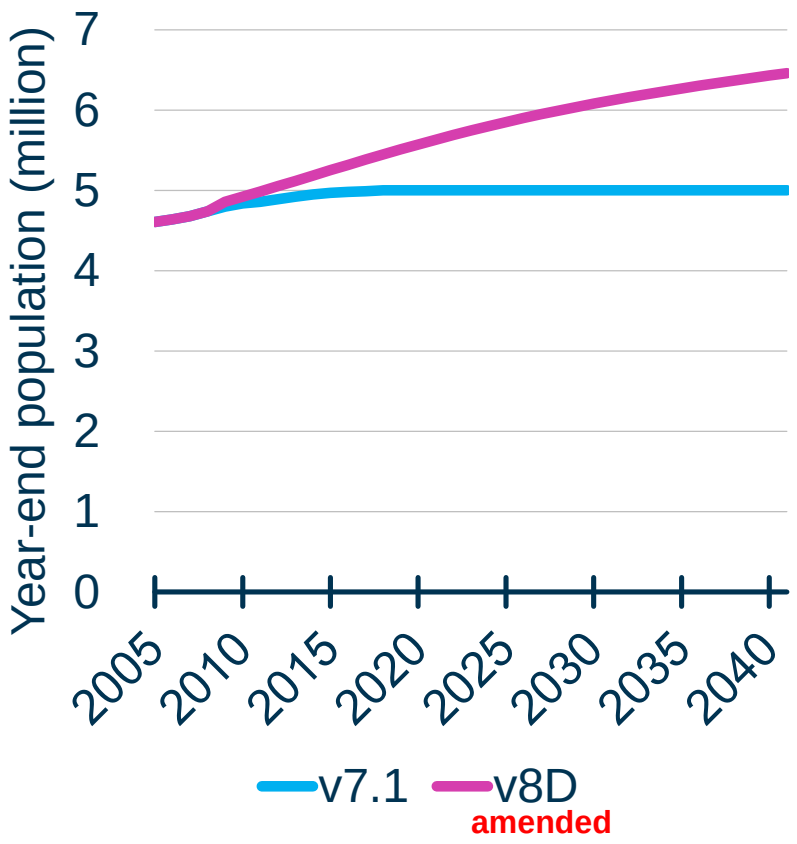
Input	Operators updated	Comments
Outgoing SMS per subscriber per month	All MNOs	Operator data used
On-net SMS per subscriber per month	All MNOs	Operator data used
Incoming SMS per subscriber per month	All operators	Both operator data and NPT market data used
Low-speed data MB per subscriber per month	All operators	Operator data used
Mobile broadband HSDPA megabytes per high-speed subscription per month	All operators	Operator data used

Source: Analysys Mason

The population forecast has also been updated

- The population forecast was updated for the years 2010–41
  - the data used comes from the Statistisk Sentralbyrå (SSB)
  - the forecast is consistent with that contained in NPT's LRIC model for fixed networks (v1.6)
- The projection is that the population will grow to 6.461 million by 2041

Population forecasts in the v7.1 and v8D models



Source: v7.1/v8D LRIC models

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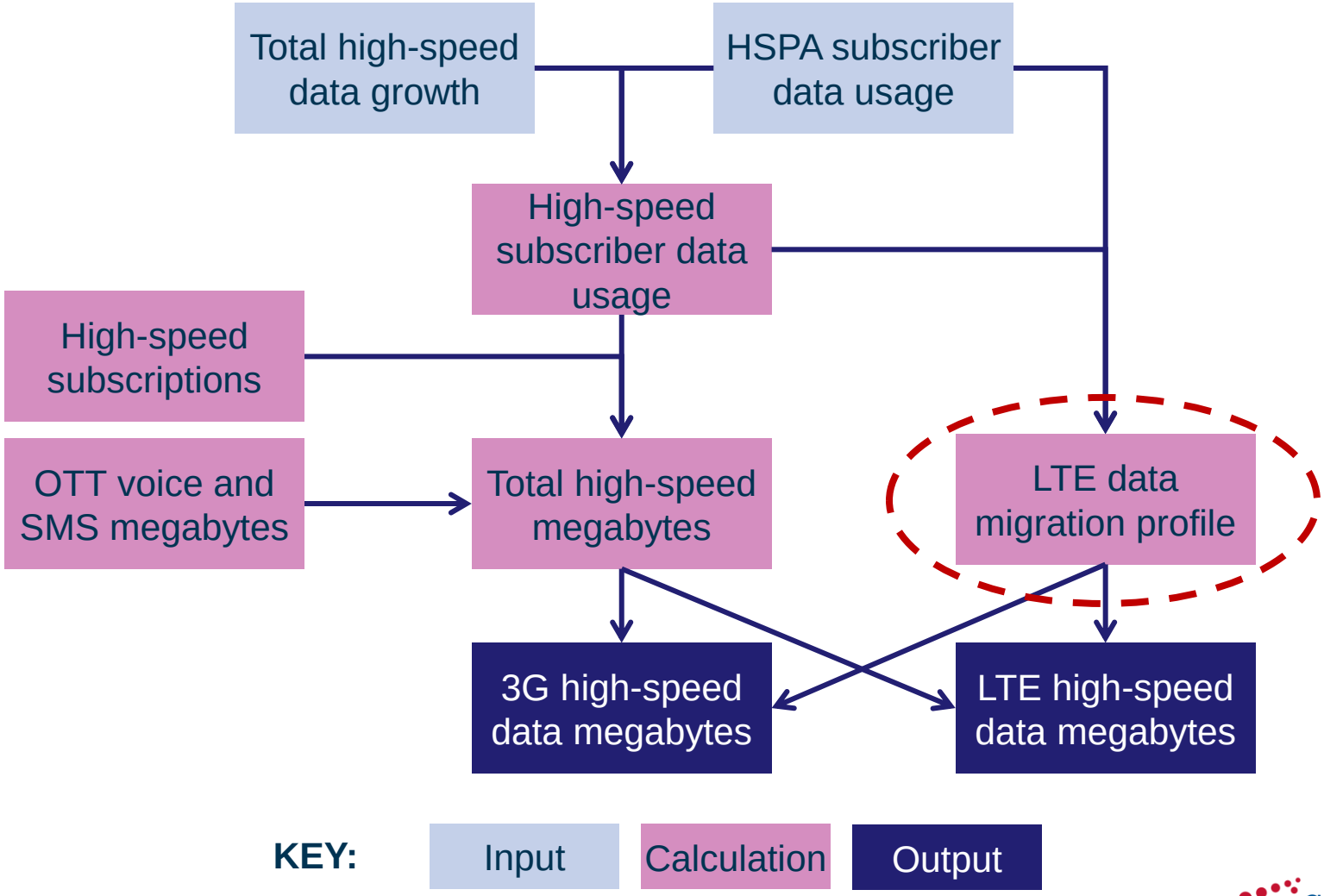
The data forecast now includes data carried on the LTE network

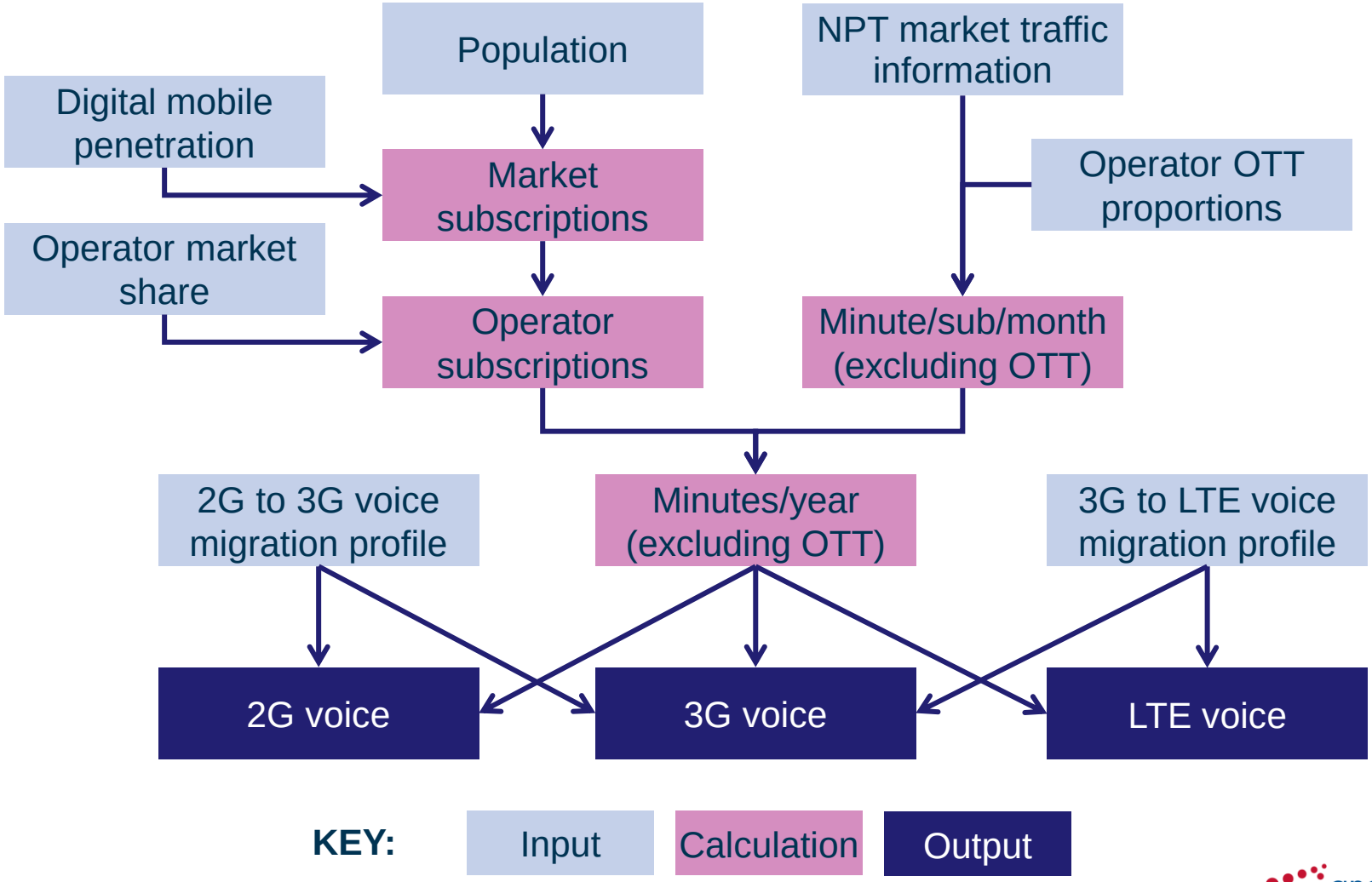
- The v7.1 model only considered data carried on the 2G/3G network
- Since that time, both Telenor and NetCom have started deploying LTE **amended**
  - roll-out has reached a number of main cities in Norway
- The ESA Recommendation explicitly states that "*the bottom-up model for mobile networks should be based on a combination of 2G and 3G employed in the access part of the network*"
  - therefore we do not believe that the cost model needs to directly model the costs of LTE services
- The v8D model now contains a holistic forecast of all high-speed mobile data traffic (i.e. HSPA and LTE)
  - a proportion of this traffic is then assumed to be carried by the modelled 3G network
  - low-speed data traffic is modelled as previously

Data on the LTE network is calculated using a new migration profile …



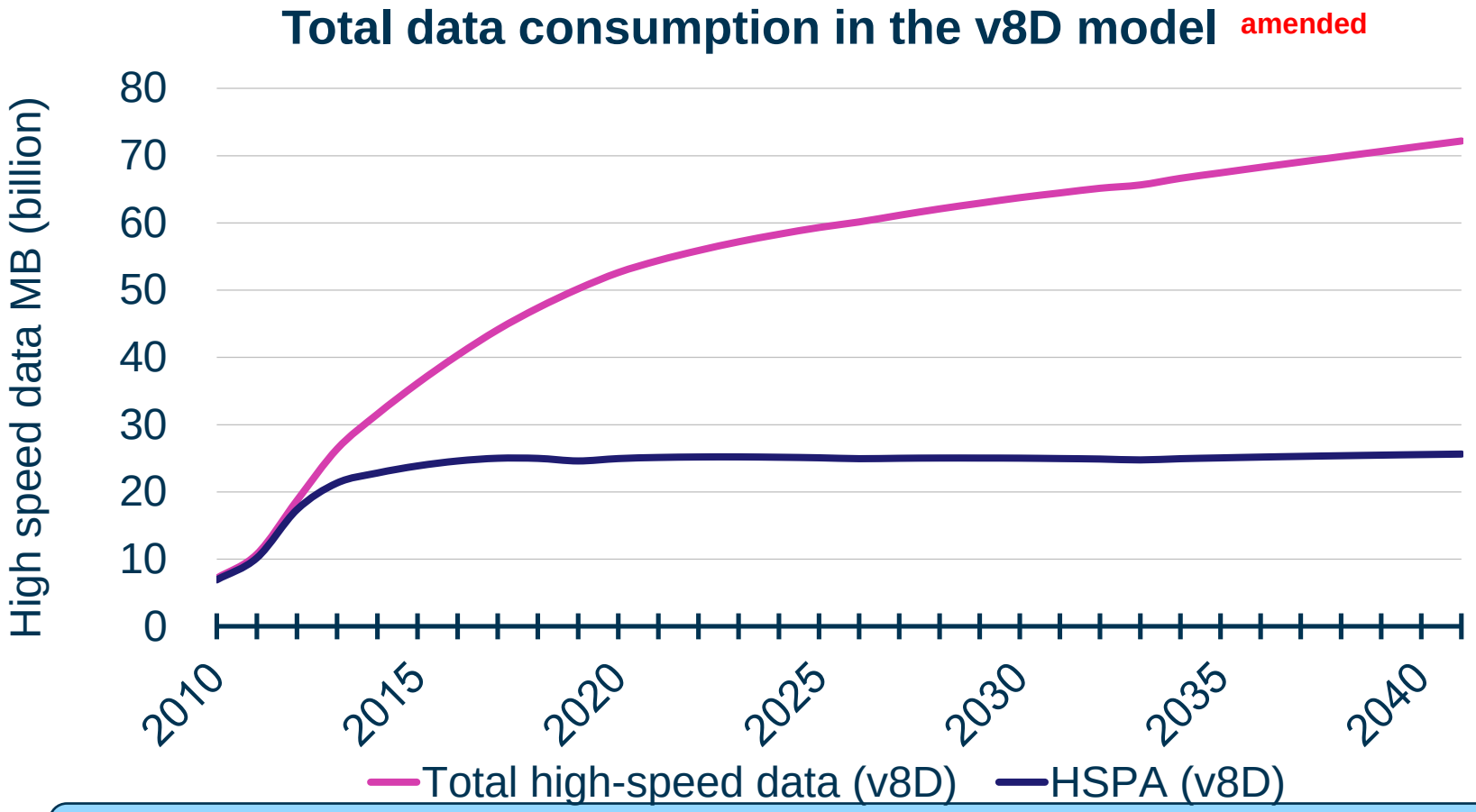
Source: Analysys Mason

… with a different profile assumed for both voice and SMS migration



Source: Analysys Mason

The growth forecasts result in a rapid increase in modelled data traffic to 2021



The continued growth in megabytes per subscriber beyond 2021 can be ascribed to the modelled increase in population and OTT service adoption

Source: Analysys Mason

Substitution of conventional voice/SMS by over-the-top (OTT) traffic is beginning

- OTT services are those that that are carried by third-party clients using data bearers
  - these are not interconnected via voice gateways since they are carried as data bits
- Therefore, operators may not necessarily know the minutes/messages carried as OTT
- In the future, substitution may occur from both conventional mobile voice/SMS usage to OTT platforms

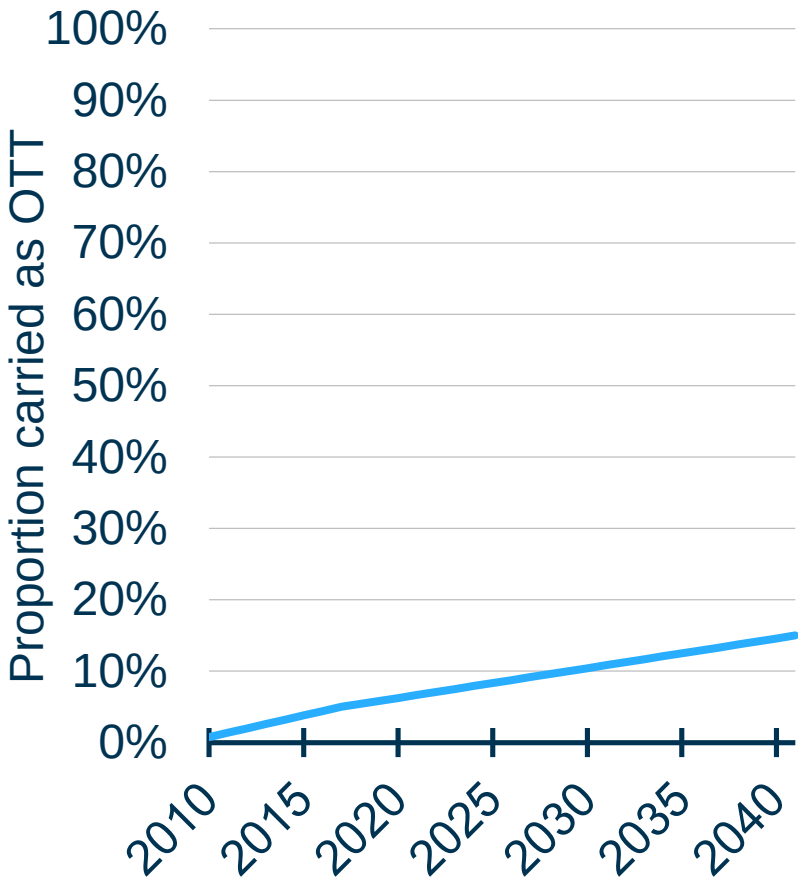
It appears that OTT usage is currently very low, so we have used conservative forecasts

NPT survey results from 2011

Frequency of Skype use	Voice	Messages
>= Daily	0.40%	2.96%
< Daily, >= Weekly	2.67%	2.54%
Other use	4.95%	9.07%
No use	91.98%	82.52%

- NPT's survey indicates current OTT usage to be very low
  - operator data supports this
- The v8D model thus considers a conservative forecast

OTT traffic forecast



Source: NPT's "The population's use of electronic communications in 2011", Analysys Mason

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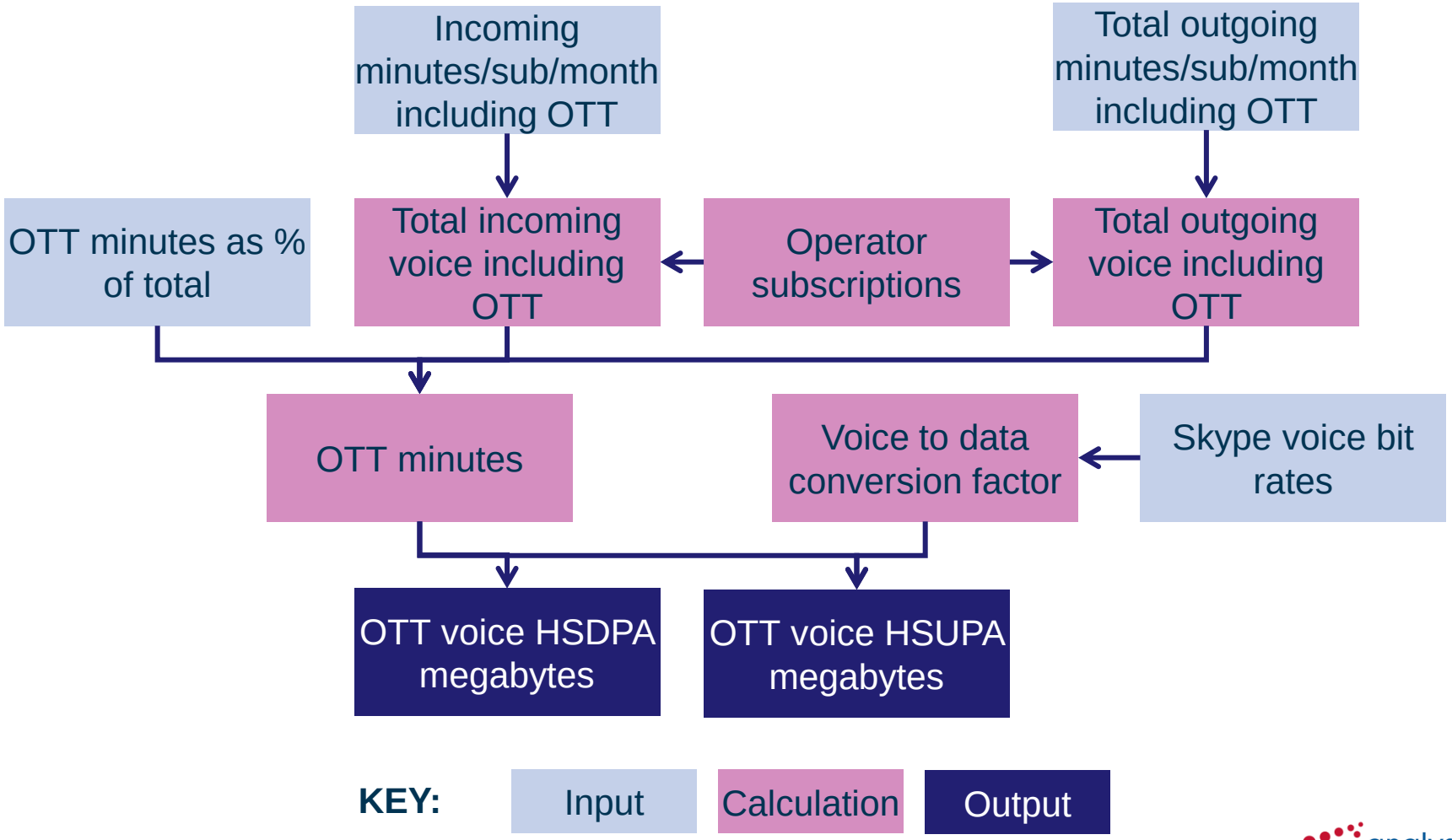
OTT voice has been separated from the total voice forecast (OTT SMS is handled similarly)



Source: Analysys Mason

The relationship between OTT voice traffic and high-speed data traffic is not one-to-one

On-net voice:

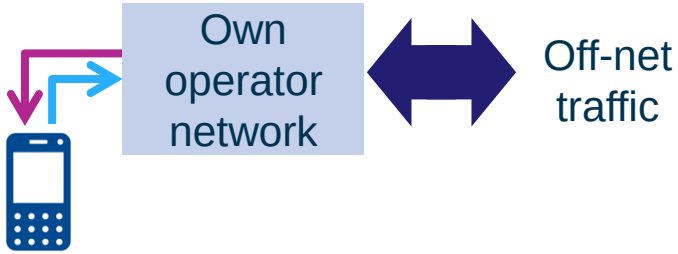
- An on-net call requires both an upload and a download of the call data for each party

On-net voice

Incoming or outgoing off-net voice:

- Similarly, both incoming and outgoing calls will require the network to upload and download the call data

Incoming/outgoing voice



KEY: → Downlink high-speed data → Uplink high-speed data

Source: Analysys Mason

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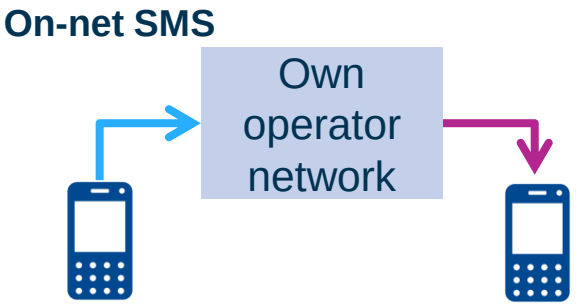
SMS traffic behaves in a similar manner to data traffic

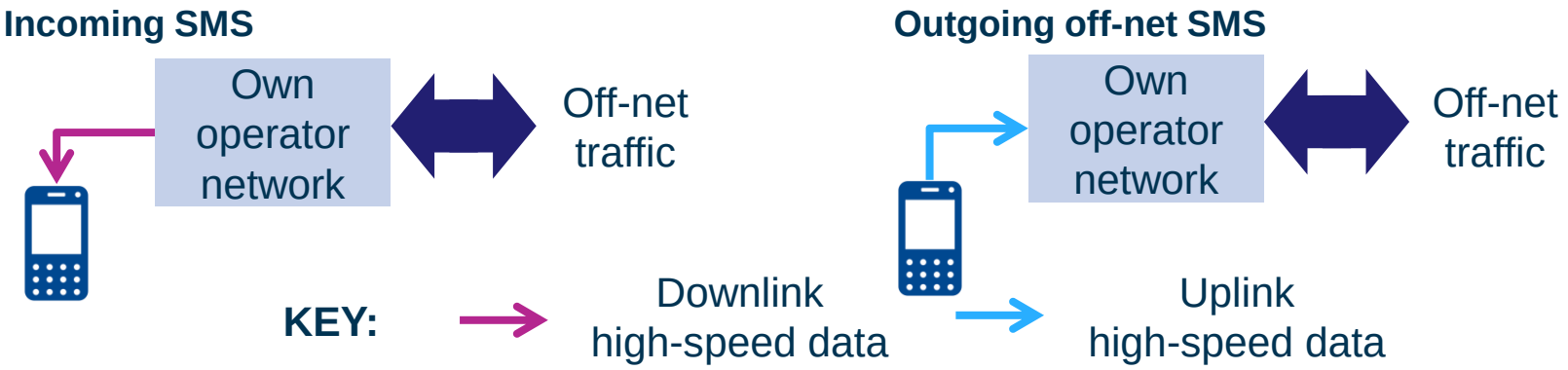
On-net SMS:

- Unlike for voice traffic, on-net OTT SMS is both downloaded and uploaded once



Incoming or outgoing off-net SMS:

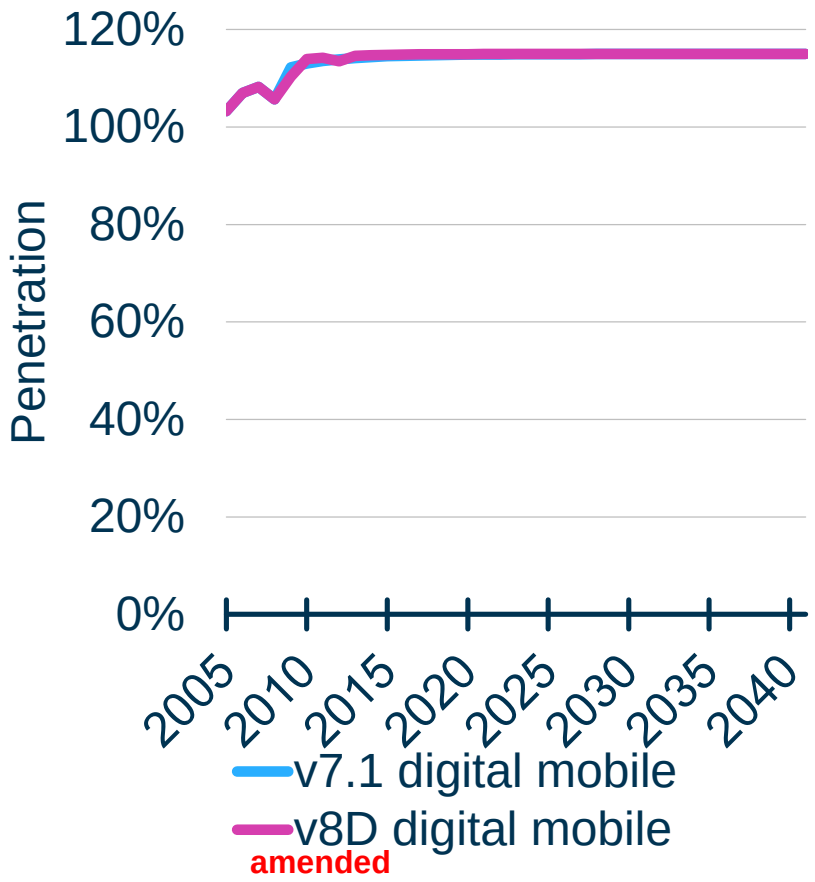
- Similarly, an incoming OTT SMS is downloaded once and an outgoing OTT SMS uploaded once



Source: Analysys Mason

In the long term, digital mobile penetration is unchanged …

Digital mobile market penetration



- The forecast increase in digital mobile penetration has been maintained
  - this saturation point remains at 115%

Source: v7.1 / v8D LRIC models

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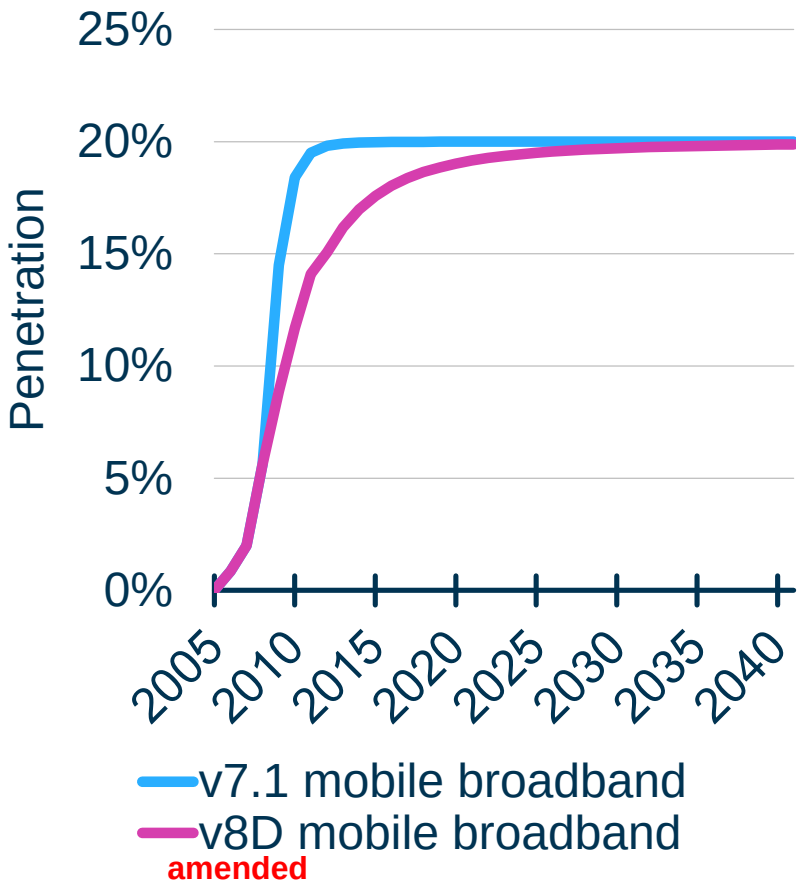
… whilst mobile broadband is forecast to reach the same endpoint more slowly

Mobile broadband market penetration



- We have projected year-on-year growth rates for mobile broadband penetration, cross-checking with NPT market data
- Our long-run mobile broadband market penetration remains 20%

Source: v7.1 / v8D LRIC models

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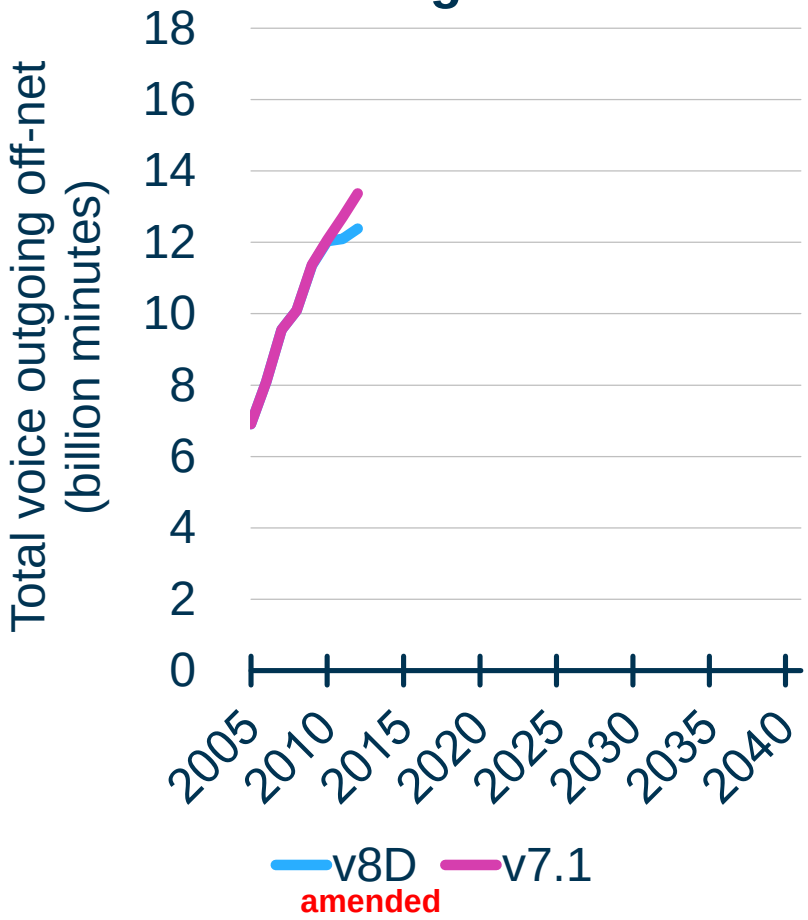
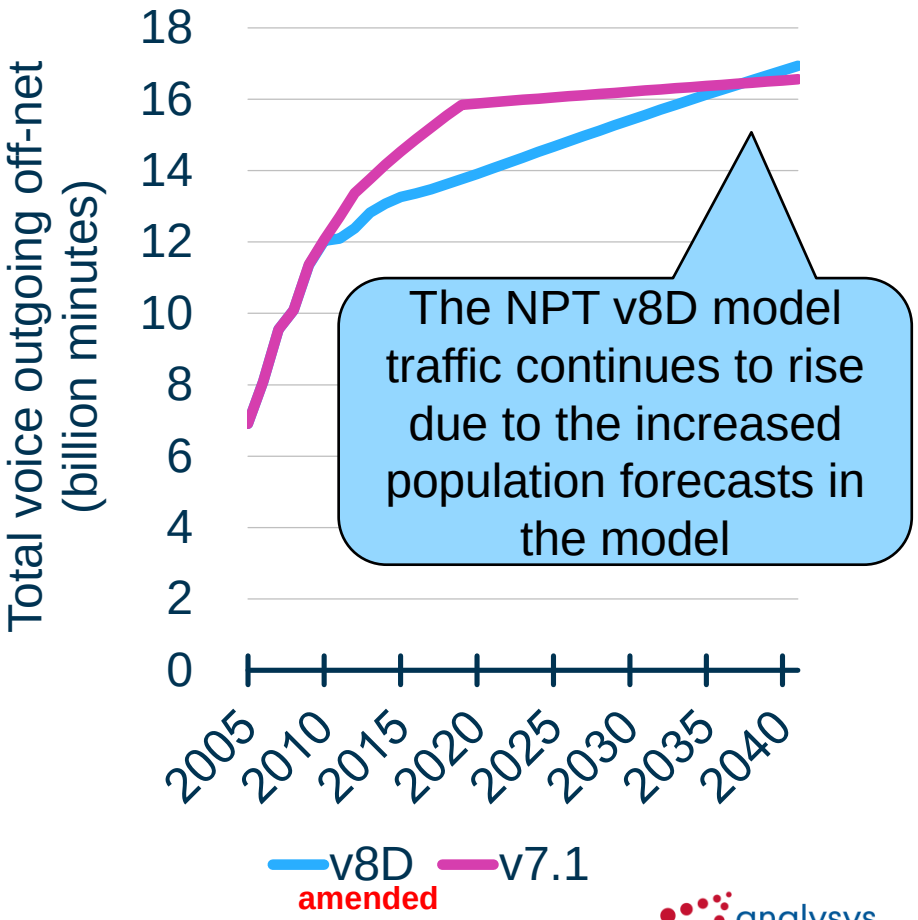
We have slightly increased the forecast of total voice origination in the long run …

Impact of the update on total voice origination



Total voice origination with smoothed forecasts



Source: v7.1 / v8D LRIC models

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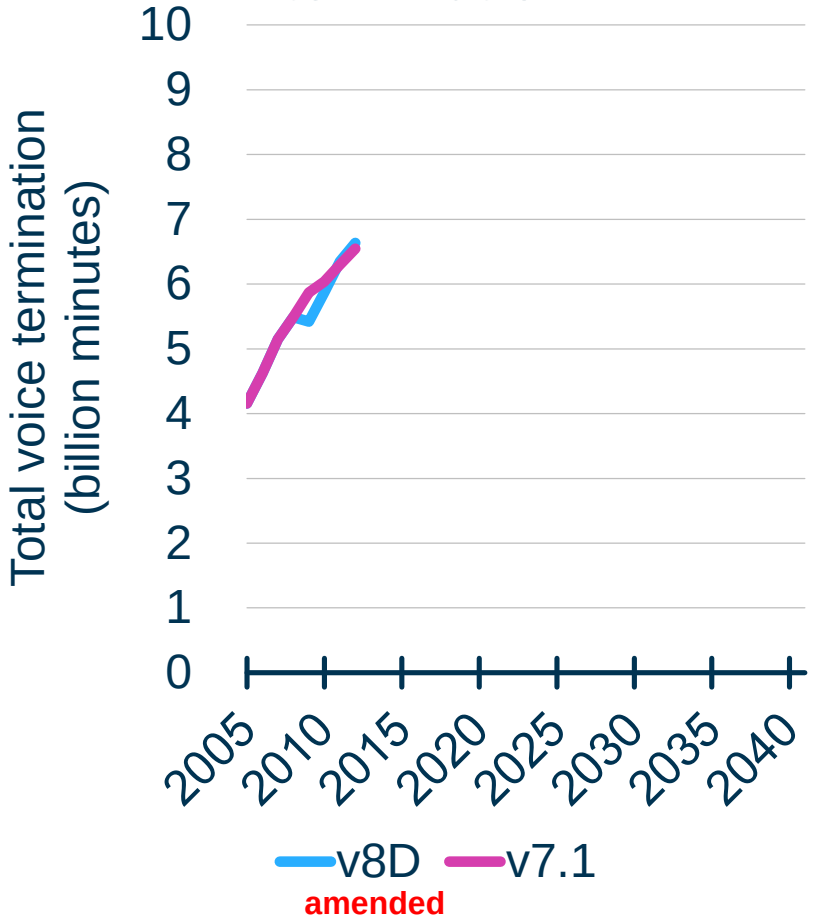
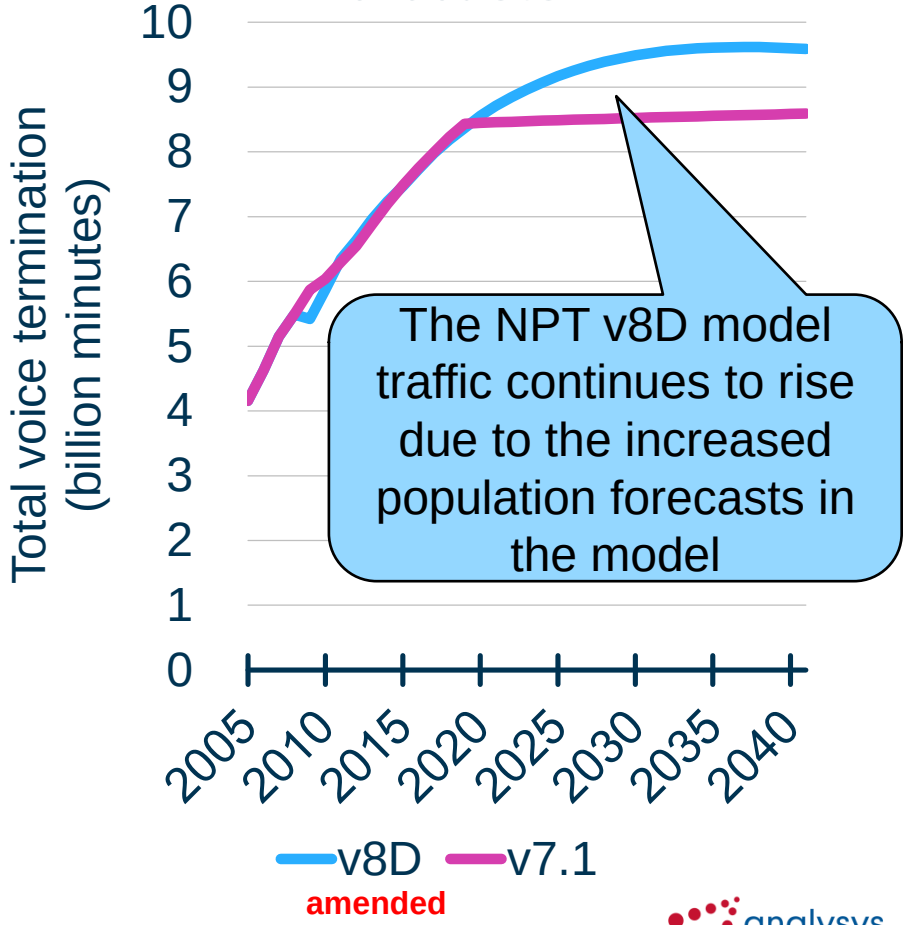
… with mobile networks also carrying more voice termination in the long term

Impact of the update on voice termination



Voice termination with smoothed forecasts



Source: v7.1 / v8D LRIC models

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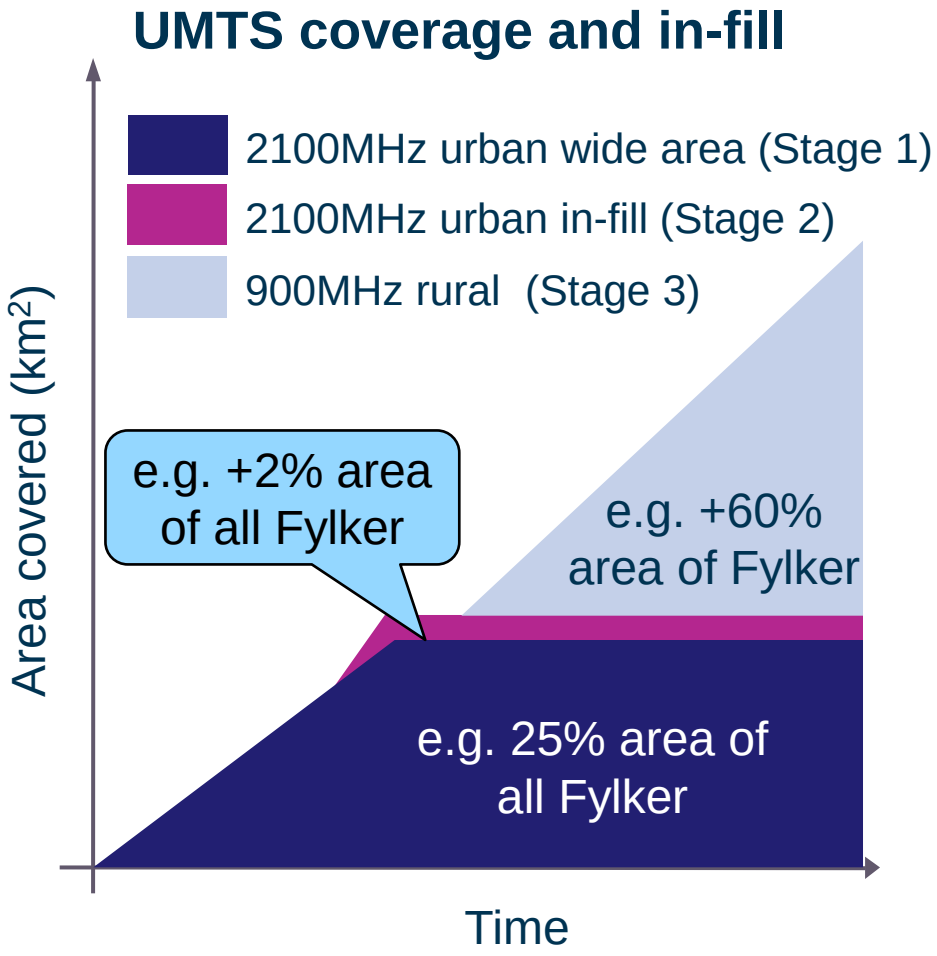
- Introduction
- Principles and concepts
- Updates to the v7.1 model
  - Market module
  - **Mobile network design**
  - Reconciliation and calibration
  - Service costing calculations
- Generic operator
- Next steps
- Supplementary material

Coverage is modelled as a mix of wide-area and in-fill deployments

- The GSM calculation uses 900MHz for national wide-area coverage, then overlays in-fill coverage in the cities
- The UMTS calculation starts with 2100MHz urban deployments (Stage 1) and overlays urban in-fill coverage (Stage 2)
  - background wide-area GSM coverage is available
- Subsequently, UMTS900 is used to extend UMTS coverage to the national rural level (Stage 3)



Source: v7.1 model documentation

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The model considers each Fylke in Norway as a separate “geotype” [1/2]

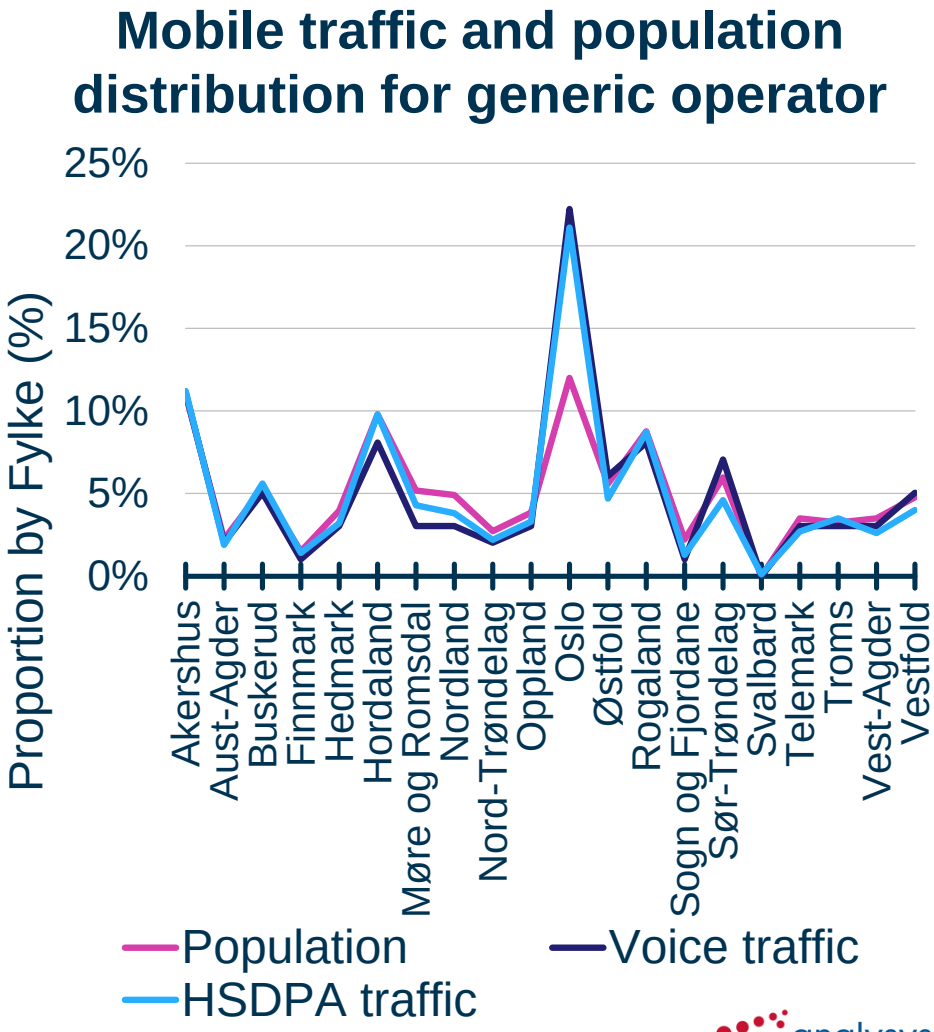
- Individual base station location data was supplied by operators to NPT
- NPT used its radio planning tools to calculate coverage by:
  - operator
  - Fylke
  - technology
- These outputs are in turn also used to derive cell radii by technology and Fylke
  - this approach was also used in the processes in 2006/2010

Norwegian Fylker

Source: Analysys Mason

The model considers each Fylke in Norway as a separate "geotype" [2/2]

- Each operator has supplied traffic data split by geotype
  - this is used to dimension the voice/low-speed data networks
- HSPA mobile broadband traffic by geotype has been dimensioned based on HSPA volumes by geotype from operators (where provided)

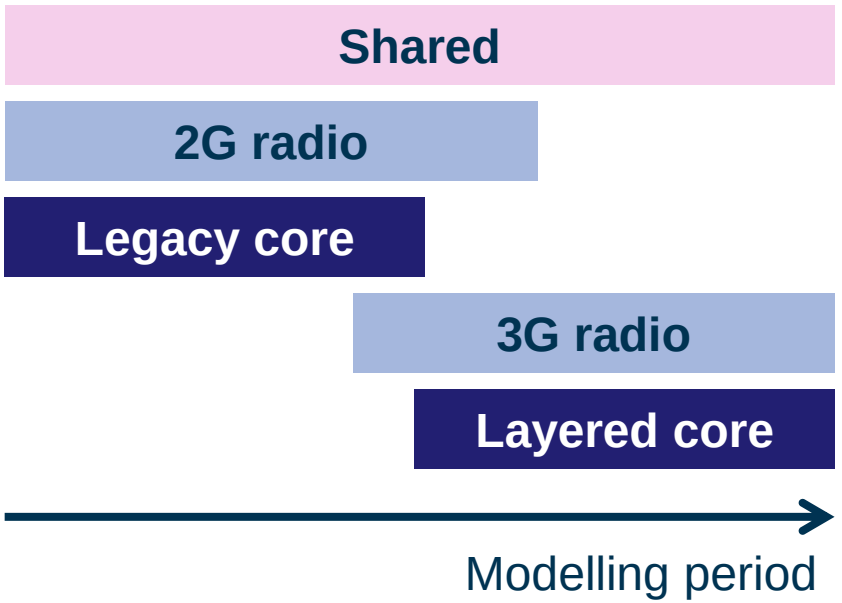


Source: Analysys Mason

Cost recovery of assets only occurs during years in which their network layers are active

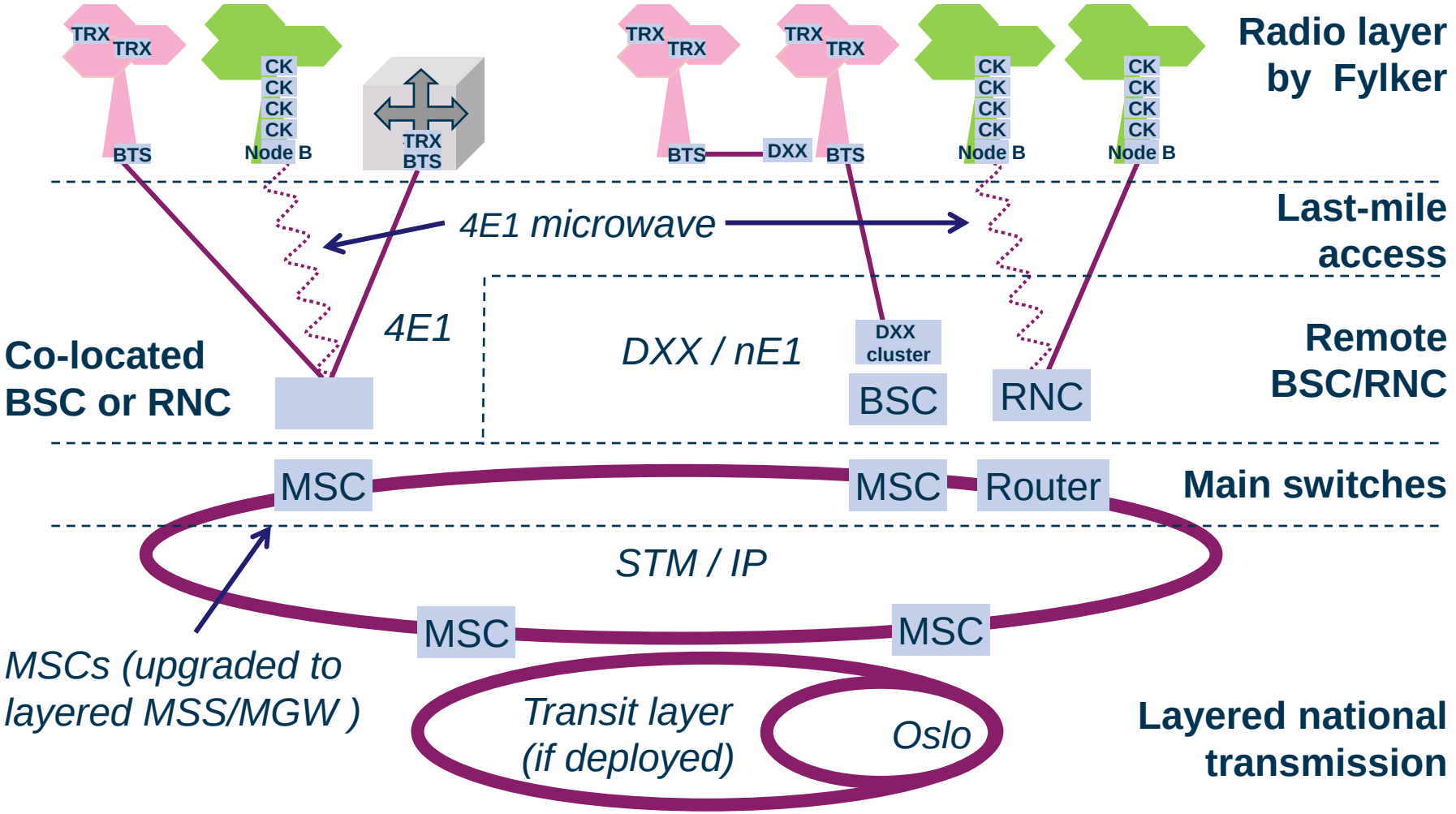
- For each 2G/3G operator, it is assumed that their networks are deployed in the following order:
  - 2G network (radio and core)
  - 3G radio network
  - layered core network, with the shut-down of the legacy 2G core network
  - shut-down of the 2G radio network
- Cost recovery of assets is then restricted to the periods in which their respective network layers are active

Periods of cost recovery by asset type



Source: Analysys Mason

Overview of mobile network

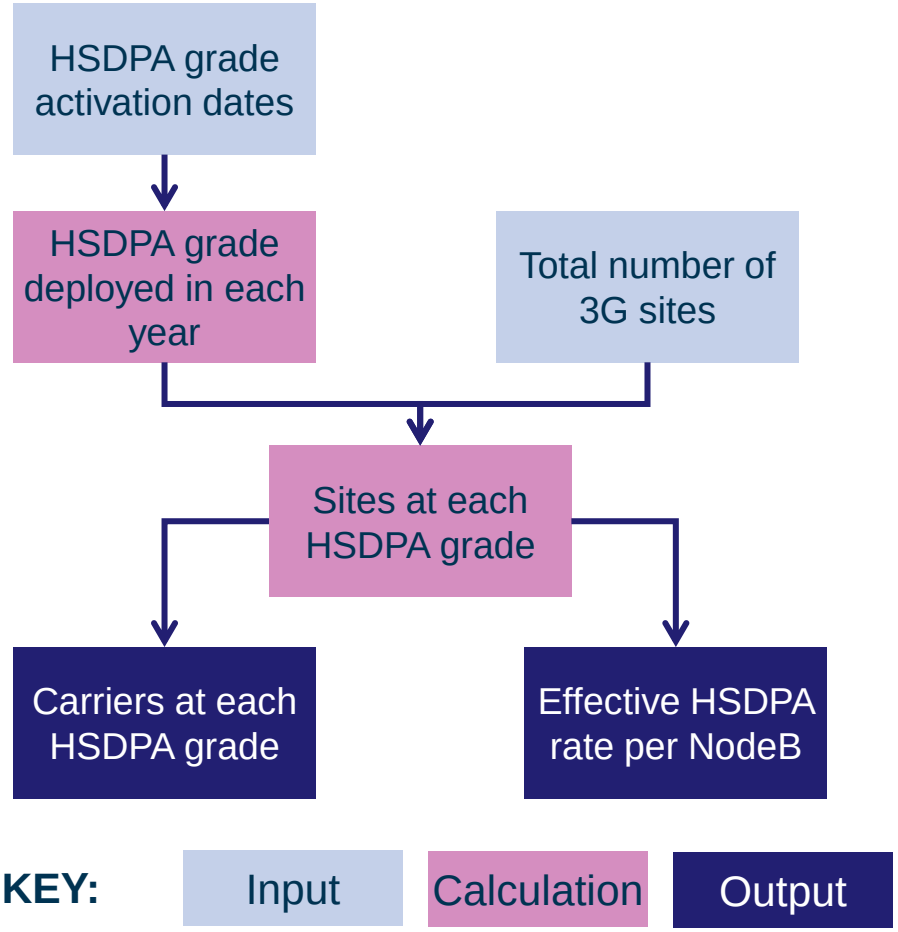


Source: Analysys Mason

HSPA radio layer upgrades and software assets have been applied in the v8D model…

- All UMTS sites (2100MHz and 900MHz) are deployed with HSDPA 3.6 as a minimum using a single, shared carrier
  - these sites carry relatively limited HSDPA volumes
- Each Fylke is upgraded to the next HSDPA grade in specified activation years

HSDPA element deployment



Source: Analysys Mason

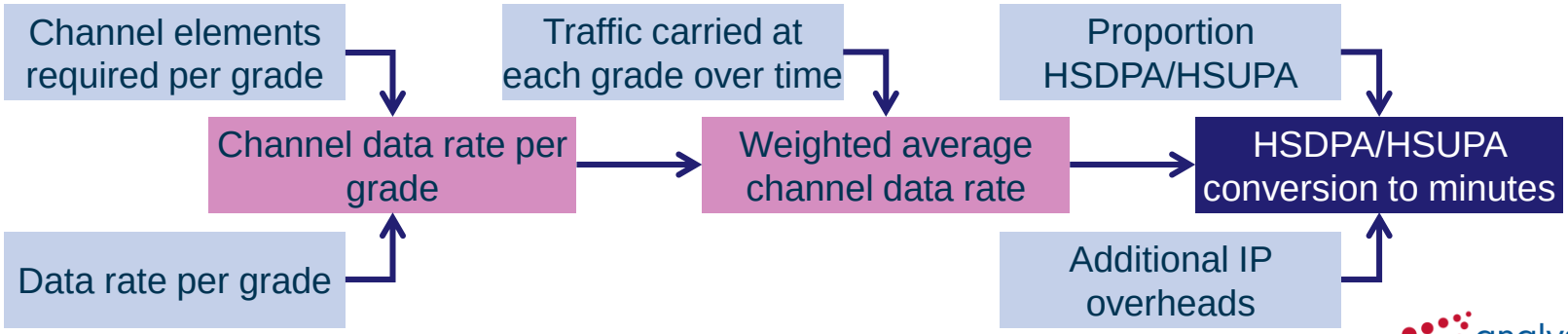
… with 5 grades now modelled for HSDPA and 2 grades for HSUPA

- 5 HSDPA and 2 HSUPA grades are deployed in the model
  - HSUPA upgrades are modelled in an identical fashion to HSDPA, using rate deployment timings
- The HSPA 'data to minutes' factor (used for cost allocation) is now based on the weighted average channel data rate

Grades of HSPA modelled

HSDPA speeds	HSUPA speeds
3.6Mbit/s	1.46Mbit/s
7.2Mbit/s	5.76Mbit/s
14.4Mbit/s	
21Mbit/s	
42Mbit/s	

Conversion factors for HSDPA and HSUPA

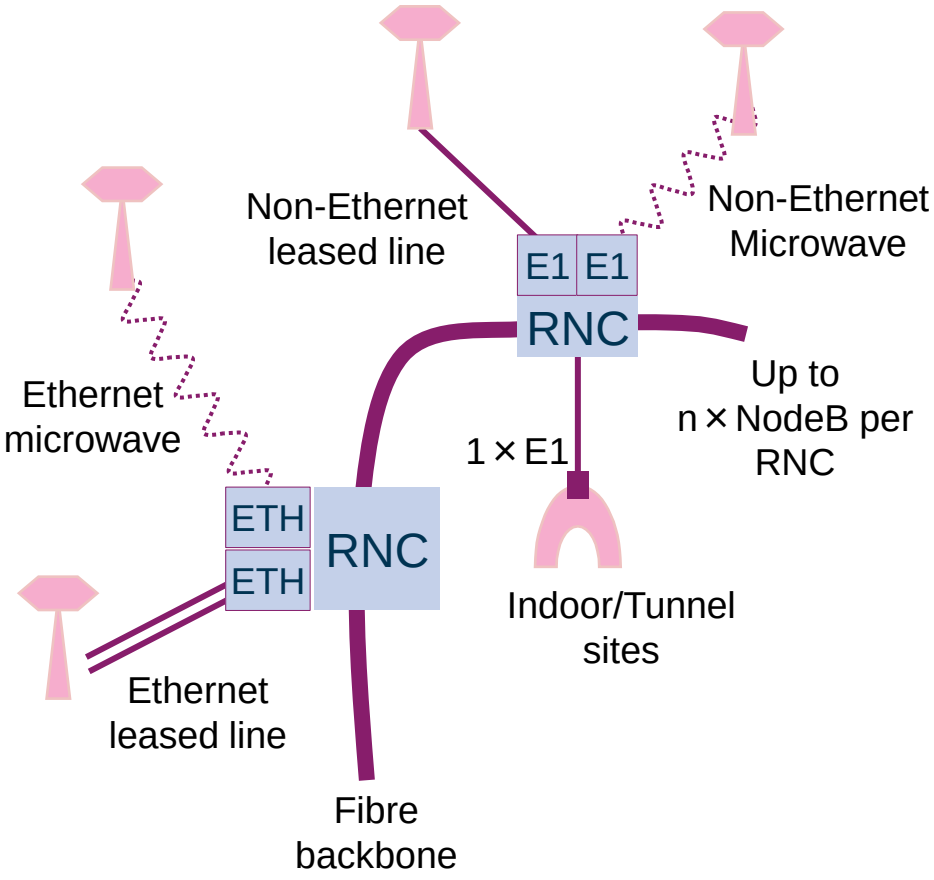


Source: Analysys Mason

LMA backhaul was upgraded to use Ethernet as an additional option

- Both Ethernet and non-Ethernet (E1/fibre) backhaul are now modelled by Fylke
  - the division of microwave/ leased line is retained
  - deployment of Ethernet is based on a migration profile
- 3G Ethernet links can vary in speed (20/50Mbit/s)
  - depends on traffic per site by geotype (voice/R99/HSDPA)
- The necessary Ethernet ports are also dimensioned

3G backhaul physical configuration



Source: Analysys Mason

The treatment of spectrum in the model and WACC has also been adapted

- We have updated the allocations and fees for the 3G spectrum licences in line with the results of the November 2012 auction*
- Minor changes have been made to the treatment of 2G spectrum licences in the model
  - these are currently renewed periodically and are assumed to increase with inflation
  - annual fees have been updated to reflect recent changes
  - the model takes no other position on future spectrum auctions and their outcomes
- The WACC has been altered in line with recommendation from Professor Johnsen's report

*See http://www.npt.no/aktuelt/nyheter/2-ghz-auksjonen-avsluttet

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  - **Reconciliation and calibration**
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The hybridisation of the cost model has been updated to 2012

- The NPT v7.1 LRIC model contained calculations of the network drivers and deployments for Telenor, NetCom and a hypothetical third operator
- The first two calculations had been hybridised from 1992–2008, via a
  - calibration exercise to ensure the network design reflects the asset volumes of the operators
  - reconciliation exercise to compare the bottom-up costing with top-down expenditure data
- In the v8D model, we have updated this hybridisation for the years to 2012 using more recent operator data
  - the hybridisation process has been replicated for Mobile Norway
- This model also includes a new costing calculation for a generic operator, with inputs based on this updated hybridisation

The calibration of the main asset classes has been updated

- The operators supplied recent network deployment data with which to calibrate network deployments in the bottom-up calculations for 2009–12
- Calibration was only possible for the years where operators provided data
- As in the original calibration exercises, inputs were adjusted to get the calculated assets as close to the top-down data as possible

Main assets calibrated

Assets
Sites
GSM900 base stations
GSM1800 base stations
TRX
UMTS2100 base stations
UMTS900 base stations
BSCs and RNCs
GGSN/SGSN

Source: Analysys Mason

Reconciliation updates led to reductions in cost trends

- Cost trends in 2009–12 were validated via:
  - a top-down comparison of opex and cumulative capex
  - comparison with unit costs provided by operators
- A more aggressive decrease in unit costs in the period 2009-12 was experienced than forecast in the v7.1 model
  - several trends were therefore revised downwards in the v8D model
- In particular, the data provided indicates that:
  - site costs have not been increasing in real terms (e.g. energy costs, site rentals)
  - radio equipment has become cheaper
- New asset costs were based on benchmarks or operator data

Source: Analysys Mason

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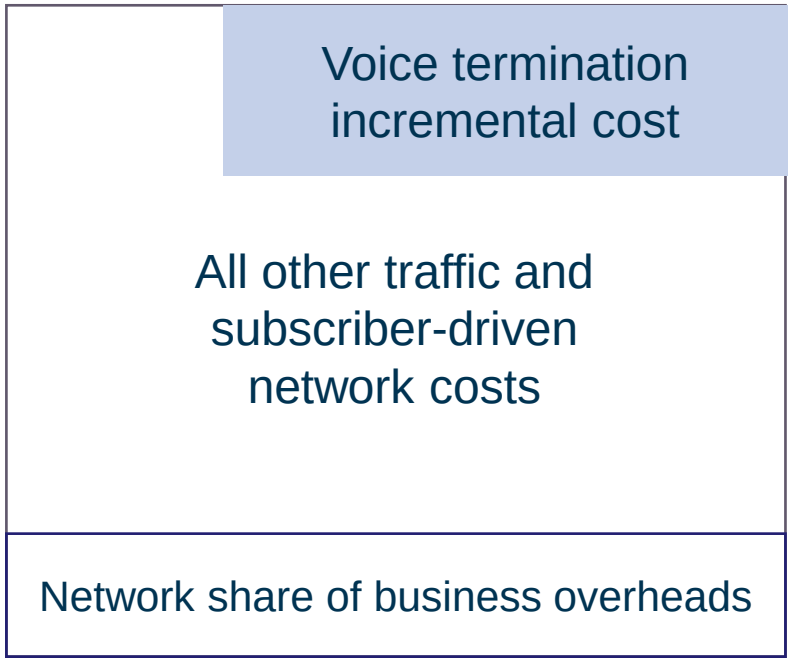
Based on NPT's requirements, we used three costing methods

- In the model, three costing approaches were implemented that differed in the definition of the increment and the treatment of common costs
- These were:
  1. **Pure LRIC**
  2. **LRIC+++**
  3. **LRIC**

1 The *Pure LRIC* approach only includes incremental costs



- The **Pure LRIC** approach was based on the EC Recommendation; it specifies that
  - only the cost '*avoided when not offering voice termination'* is allocated to this service
  - wholesale termination is treated as the 'last' service in the network
  - non-traffic related costs, such as subscriber costs, are not allocated
  - network common costs and business overheads are not allocated to the end result

Source: Analysys Mason

The model can calculate 4 "forms" of Pure LRIC, but one is the focus of the consultation

	Network design adjustments: "Purest"	Network design adjustments: "Pure"	
Calculate difference before/after economic depreciation (ED)	• No network adjustments • Incremental difference **after** ED	• Include network adjustments • Incremental difference **after** ED	
	• No network adjustments • Incremental difference **before** ED	• Include network adjustments • Incremental difference **before** ED	The focus of the v8D model will be on this approach

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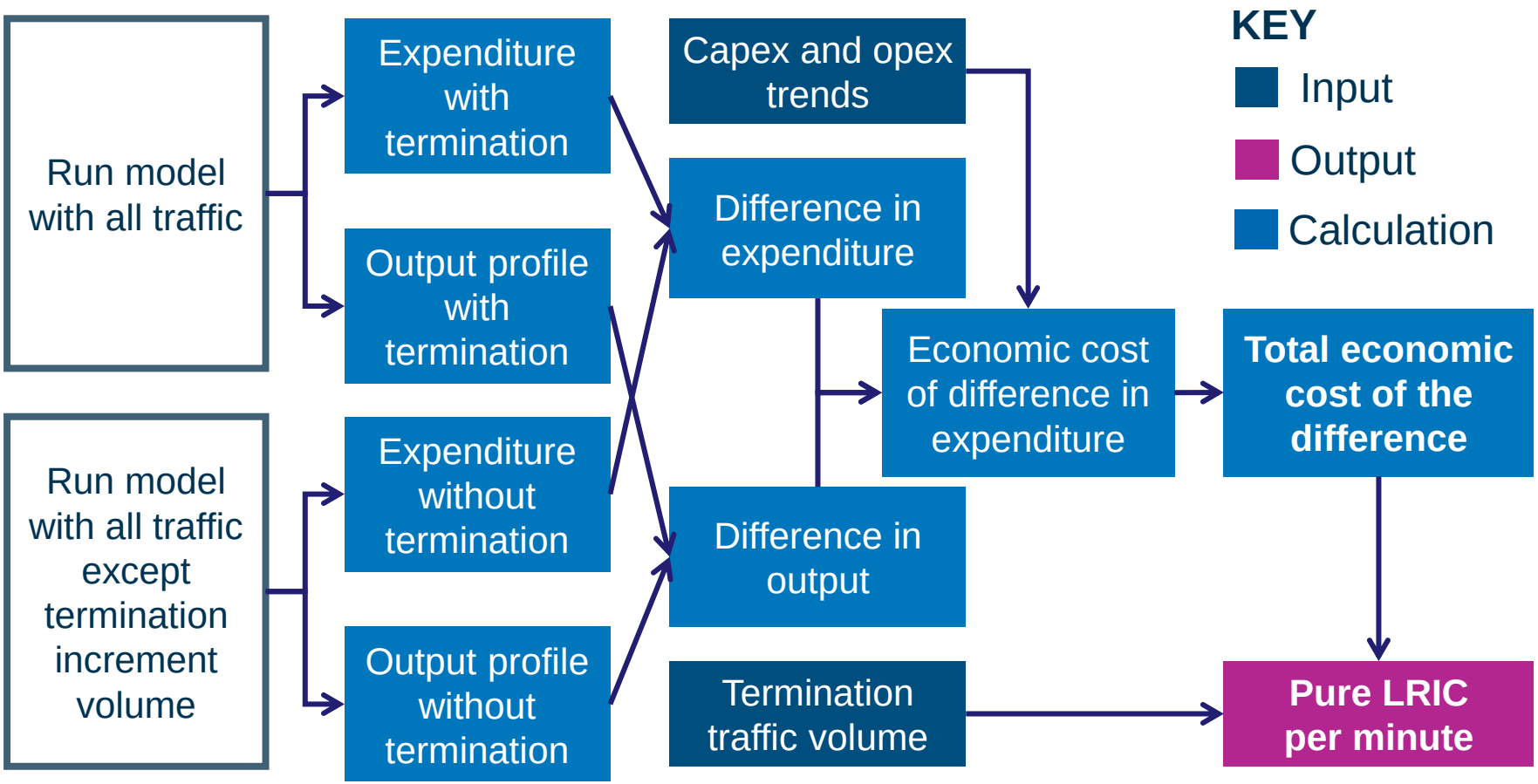
1 This form of *Pure LRIC* calculation uses the difference between two modelling states



Source: Analysys Mason

The network design responds to the removal of termination traffic …

- When the model is run in the absence of terminated traffic, the lower traffic loading reduces the modelled number of assets over time
- We then derive an "avoidable cost" over time
- We have further refined the pure LRIC calculation in two stages:

A. Adjustments to the network design to increase traffic sensitivity

B. Adjustments to the costing calculation to include non traffic-sensitive costs where appropriate

Asset groups that vary with removing termination, with the network design "as is"

Asset groups
Radio sites
BTS, repeaters and TRX
NodeB, carriers, channel kit
Last-mile access backhaul
BSC
RNC
Ports (E1, STM1, Ethernet)

Source: Analysys Mason

A … but we have included further calculation adjustments to the network design …

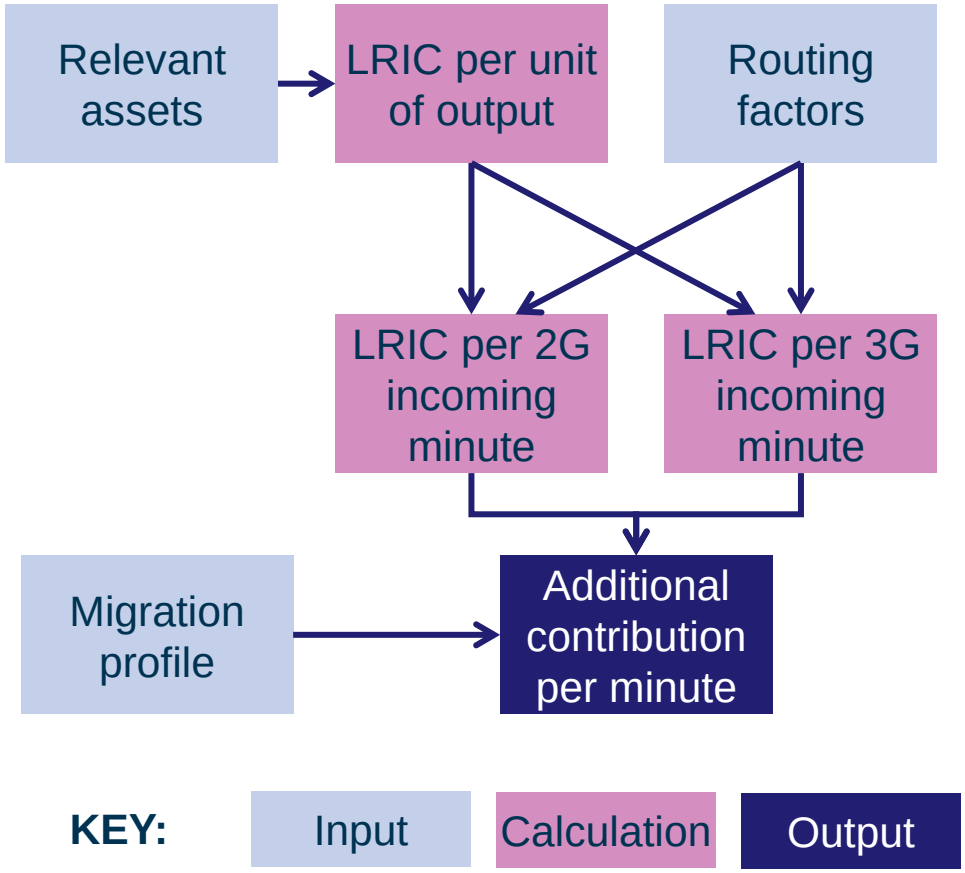
- Certain parts of the network design do not lead to avoided assets, when it could be argued technically that assets would be avoided
- We therefore have included adjustments in the network calculation that alter how asset counts are calculated when excluding voice termination
- These adjustments in the v8D model are:
  - a smaller-scale deployment of GSM in-fill coverage sites when termination is not included
  - a slight increase in the 3G cell radii (accounting for “cell breathing”) for the six most urban Fylker* when termination is not included
- Including these adjustments increases the modelled avoidable cost and thus the resulting pure LRIC

** Akershus, Hordaland, Oslo, Østfold, Rogaland and Vestfold*

B … and functionality to capture non traffic-sensitive costs (if appropriate)

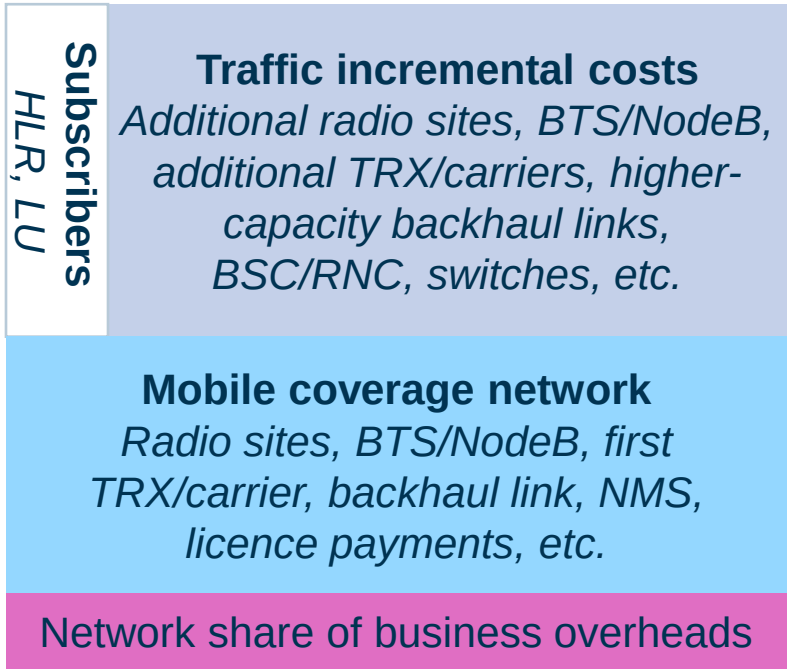
- Certain assets are not dimensioned to be traffic-sensitive, when it could be argued that they should e.g.
  - wholesale costs (network billing, IN platform, NMS)
- We have included the functionality to incorporate the ***LRIC*** contribution from chosen assets as a mark-up to the ***Pure LRIC***
  - but not if costs are already avoided for that asset

Additional contributions to the Pure LRIC



Source: Analysys Mason

2+3 *LRIC+++* was consistent with previous regulatory costing; LRIC excludes mark-ups



- The **LRIC+++** approach focused on consistency with the previous approach in Europe for fixed and mobile termination costing

- Average incremental costs of traffic were defined in aggregate, then allocated to various traffic services using routeing factors
  - this is the **LRIC**
- Common costs were included (using three equi-proportionate, cost-based mark-ups)
  - network common costs
  - location updates
  - administrative overheads

Source: Analysys Mason

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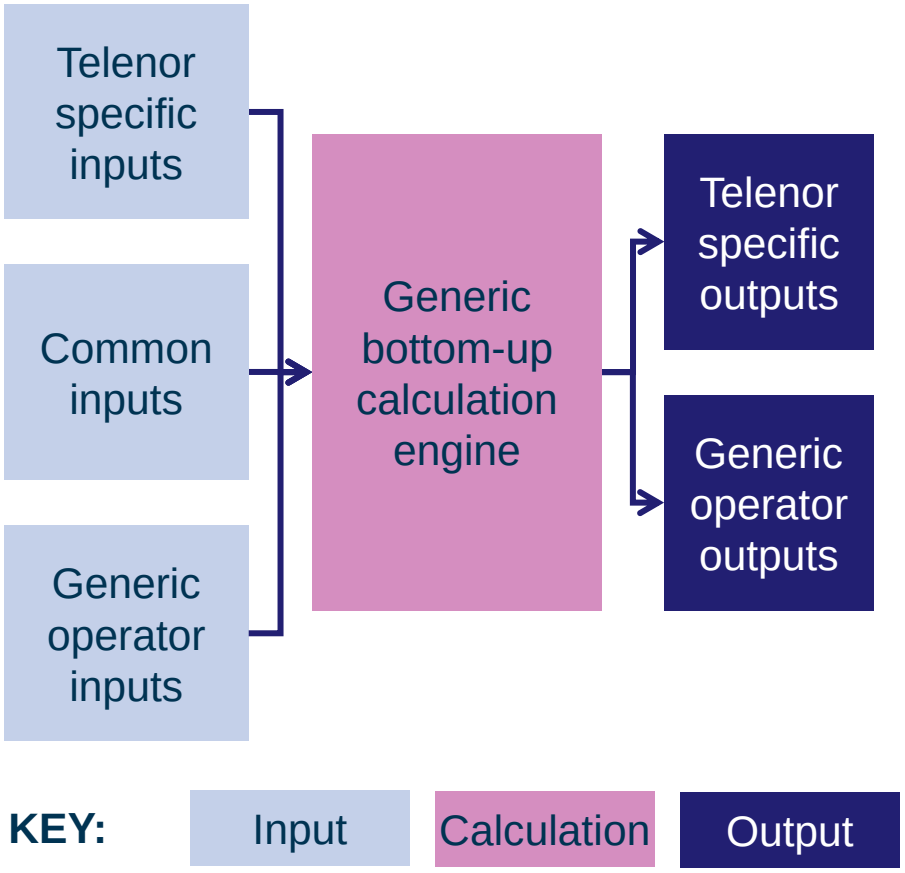
A generic operator calculation has been added to the v8D model

- In addition to the cost calculations of the actual operators, the model includes a generic operator for the Norwegian mobile market
  - this is in line with the EC Recommendation's description of an "efficient-scale operator"
- Industry parties will only see their own inputs (if any) and the generic operator inputs
  - this allows the generic operator calculation to be fully shared with industry parties, thus increasing transparency

Model as visible to operators (Telenor illustrated)



Source: Analysys Mason

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The previous definition of the third operator had options that needed choosing in principle

Criteria	Options			
Date of entry	1993	2008	2012	2013 (today)
Time to achieve footprint	Immediate	Fast	Slow	
Choice of technology	2G-3G	2G-3G-LTE	3G-LTE	3G-only
Target market share	20% (minimum efficient?)	33.3%	1/N	
Time to achieve full market share	Immediate	Fast	Slow	

v7.1 (hypothetical third operator) approach

Source: NPT v7.1 model documentation

The definition of the new generic operator requires similar choices*

Criteria	Options			
Date of entry	1993	2008	2012	2013 (today)
Time to achieve footprint	Immediate	Fast	Slow	
Choice of technology	2G-3G	2G-3G-LTE	3G-LTE	3G-only
Target market share	20% (minimum efficient?)	33.3%	1/N	
Time to achieve full market share	Immediate	Fast	Slow	

v7.1 (hypothetical third operator) approach

Proposed v8D (generic operator) approach

** Where these cannot be derived as the average of actual operators*

The generic operator is assumed to be a 2G/3G/LTE entrant reaching immediate scale

Assumption	Description
Date of entry	2012 asset purchase for 2013 network launch
Time to achieve footprint	Immediate scale in 2013
Choice of technology	2G, 3G and LTE networks – though the LTE network is not explicitly modelled
Target market share and time in which to achieve it	Average value based on number of networks (35% for voice, 33% for data); achieved immediately **amended**
Spectrum holdings	Average allocations of the three MNOs
2G to 3G deployment and migration profile	2G shutting down in 2020 and 3G in perpetuity. Migration profile equal to average of three MNOs
Spectrum payments	Based on the payments in each band of the actual operators (normalised per MHz)
Core architecture	All IP core from launch
Most network/cost inputs	Averages of the actual MNO values

Source: Analysys Mason

We have considered the coverage of the GSM and UMTS networks for the generic operator

- We assume almost ubiquitous population coverage for GSM using 900MHz
  - 80% of coverage is wide area
  - the remaining 20% of coverage is in-fill
- UMTS coverage is assumed to use both 2100MHz and 900MHz
  - long-run coverage is assumed to be for 99.9% of population

Comparison of 2100MHz + 900MHz UMTS area coverage by Fylke

Fylker	UMTS coverage
Oslo, Vestfold, Østfold	90–100%
Akershus, Nord-Trøndelag, Sogn og Fjordane, Hedmark, Møre og Romsdal	80–90%
Vest-Agder, Telemark, Rogaland	70–80%
Buskerud, Sør-Trøndelag, Troms, Nordland, Aust-Agder	60–70%
Hordaland, Finnmark, Svalbard, Oppland	50–60%

Source: NPT v8D model

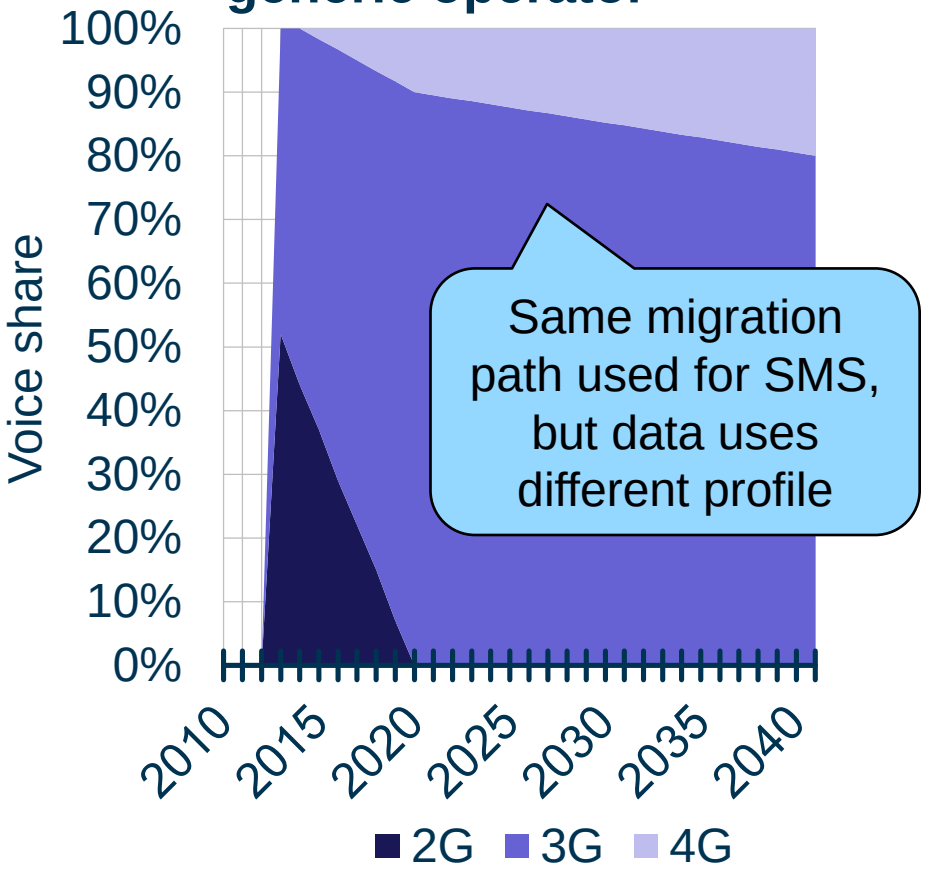
The assumed market shares are based on the number of coverage networks in Norway

- Voice and data market shares are based on the assumed long-term coverage of networks in Norway
- For voice, it is assumed Norway is covered by 2.85 networks

  100%/(100%+100%+85%*) = 35%
- For data, 95% of the market is assumed to be covered by 2.85 networks **amended**

  95%/(100%+100%+85%) = 33.3%
- The migration profile is assumed to be the average of the modelled operators

Modelled voice migration for generic operator **amended**



** Mobile Norway is assumed to reach 85% population coverage in the long run*

*** Nordisk/ICE is assumed to support 5% of the Norwegian data market*

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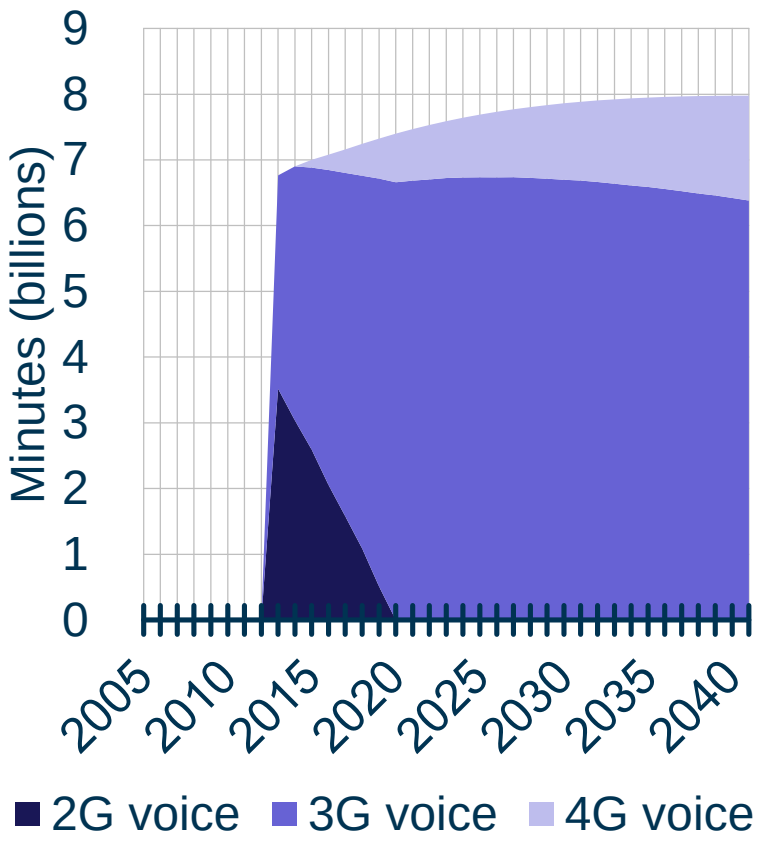
We assume a steadily decreasing volume of voice/SMS traffic on the 2G/3G networks…

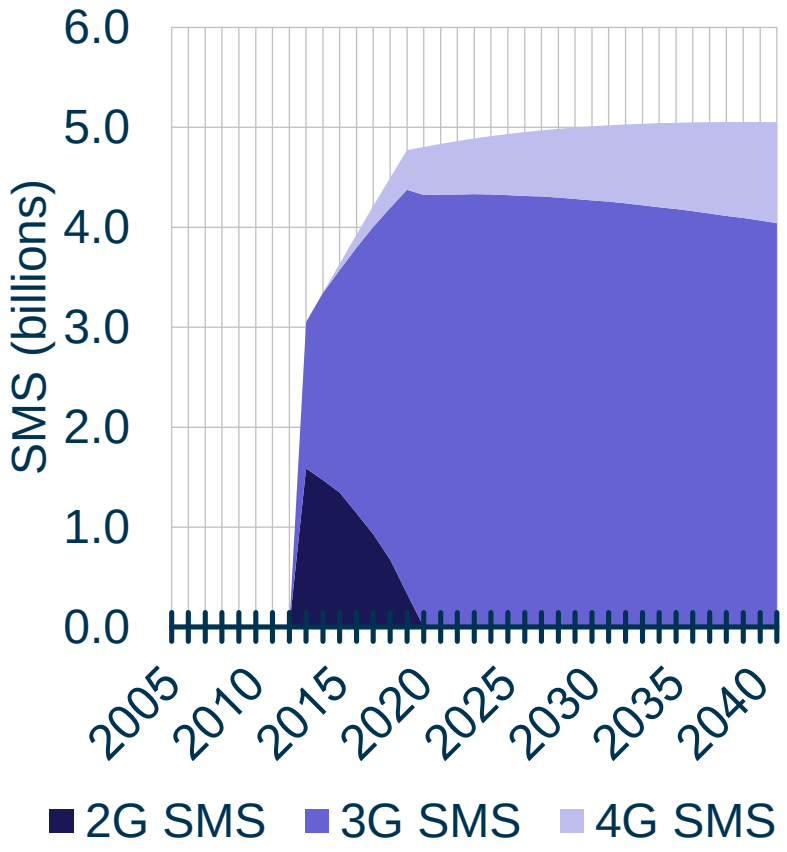
Voice traffic for generic operator

amended



SMS traffic for generic operator

amended



Source: v8D model

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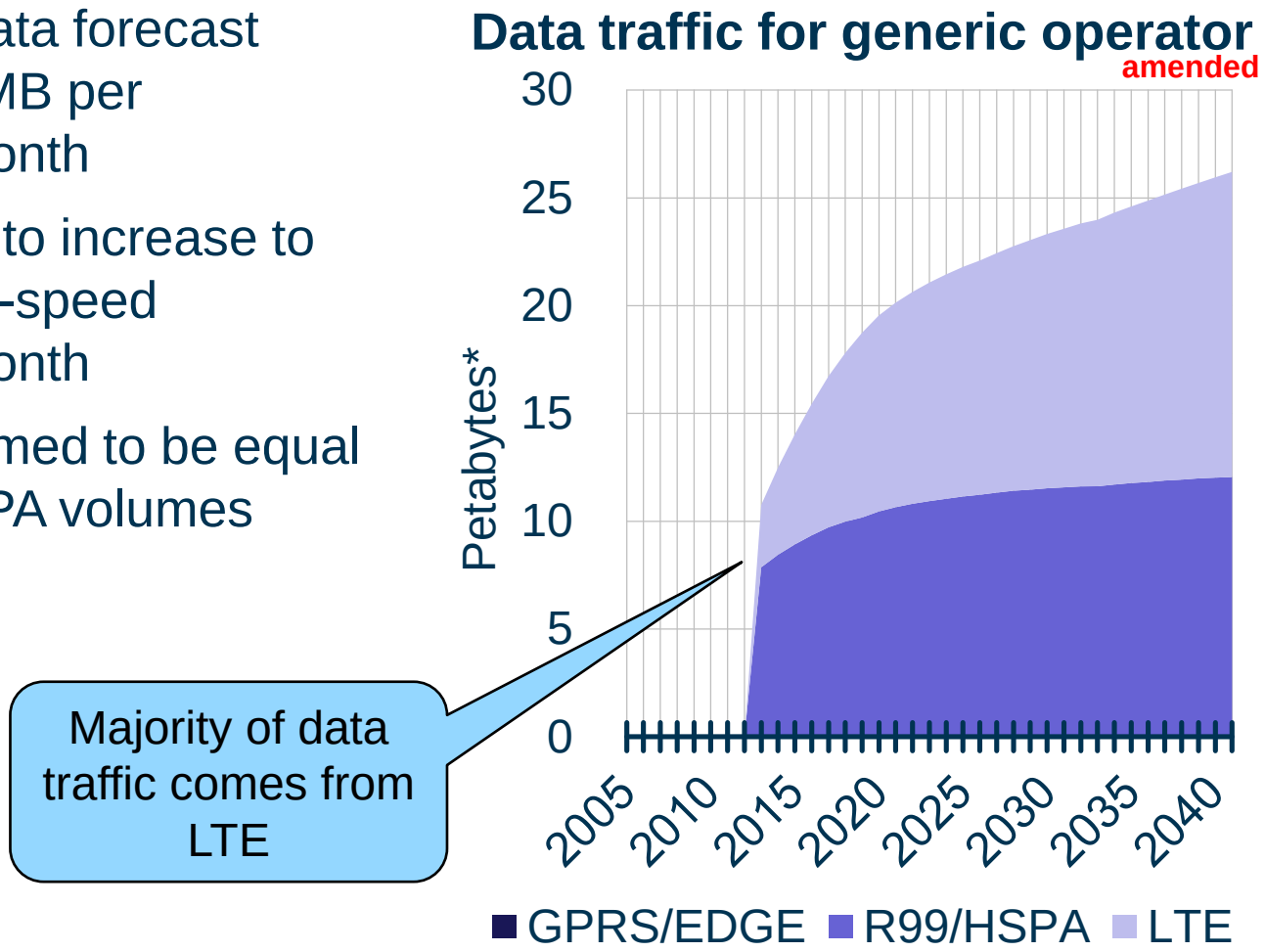
… and relatively stable HSPA data usage (with most of the increase carried on LTE)

- The low-speed data forecast stabilises at 100MB per subscriber per month
- HSPA is forecast to increase to 1750MB per high-speed subscriber per month
  - HSUPA is assumed to be equal to 25% of HSDPA volumes



Source: v8D model

** 1 petabyte = 1 billion megabytes*

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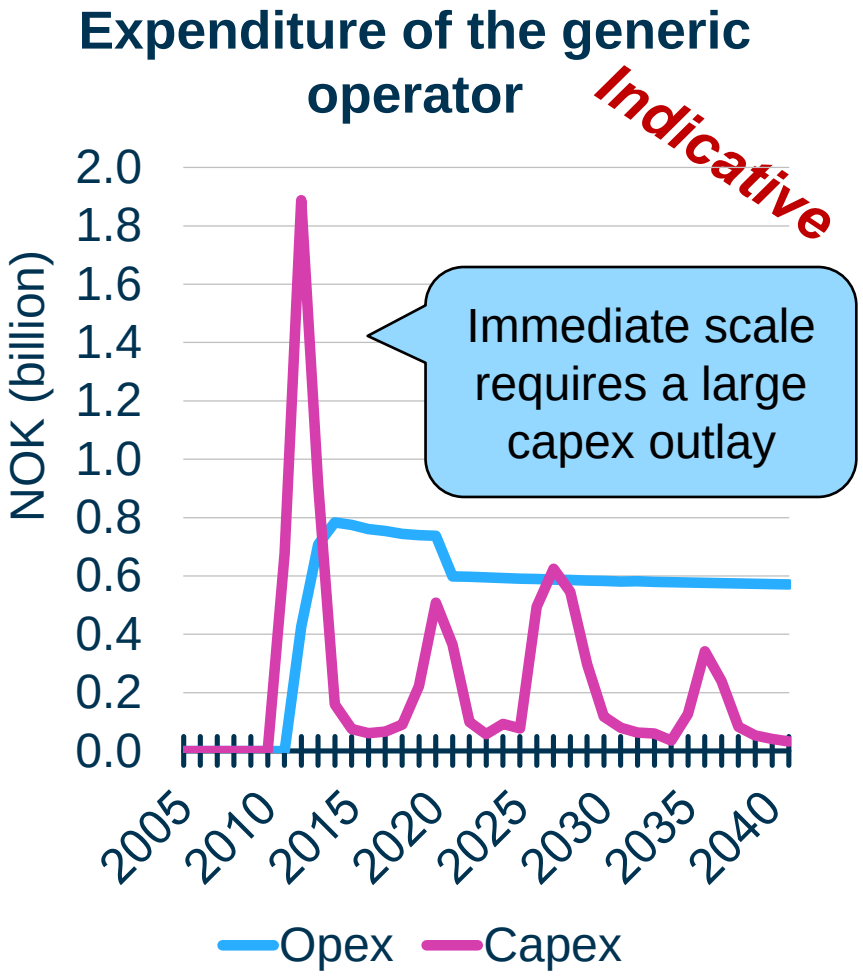
The cost base of the generic operator is derived from actual operator costs

- Most of the cost base of the generic operator is based on average values across the actual operators
- Modelled opex decreases slightly after the 2G network is shut down, which is assumed to occur in 2020



Source: v8D model

amended

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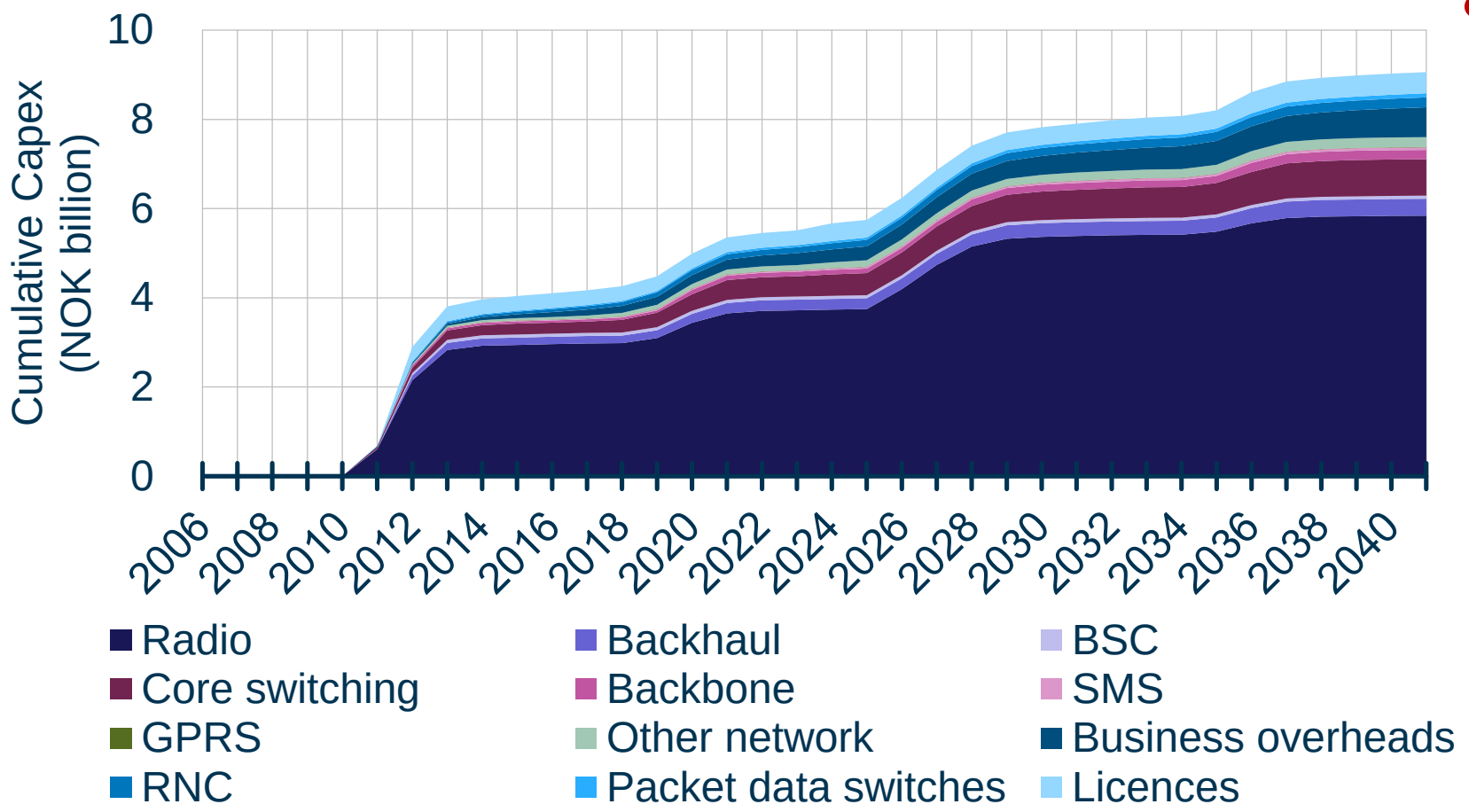
The generic operator is forecast to require almost NOK9 billion of capex …

Indicative

amended

Categorised capex over the period 2012–41



Source: v8D model

amended

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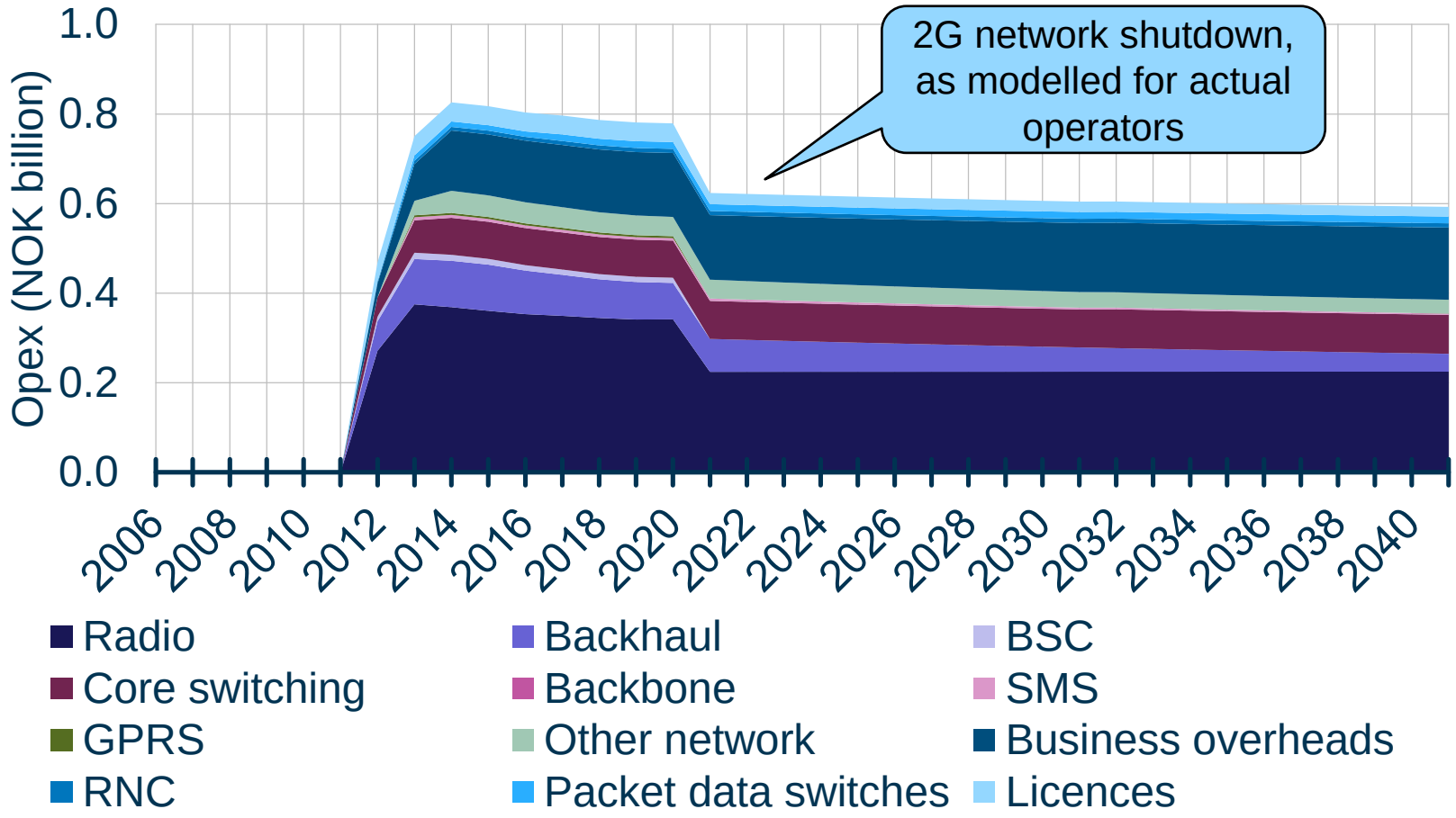
… with an annual 2G+3G opex of approximately NOK0.8 billion

Indicative

amended

Categorised opex over the period 2012–41



Source: v8D model

amended

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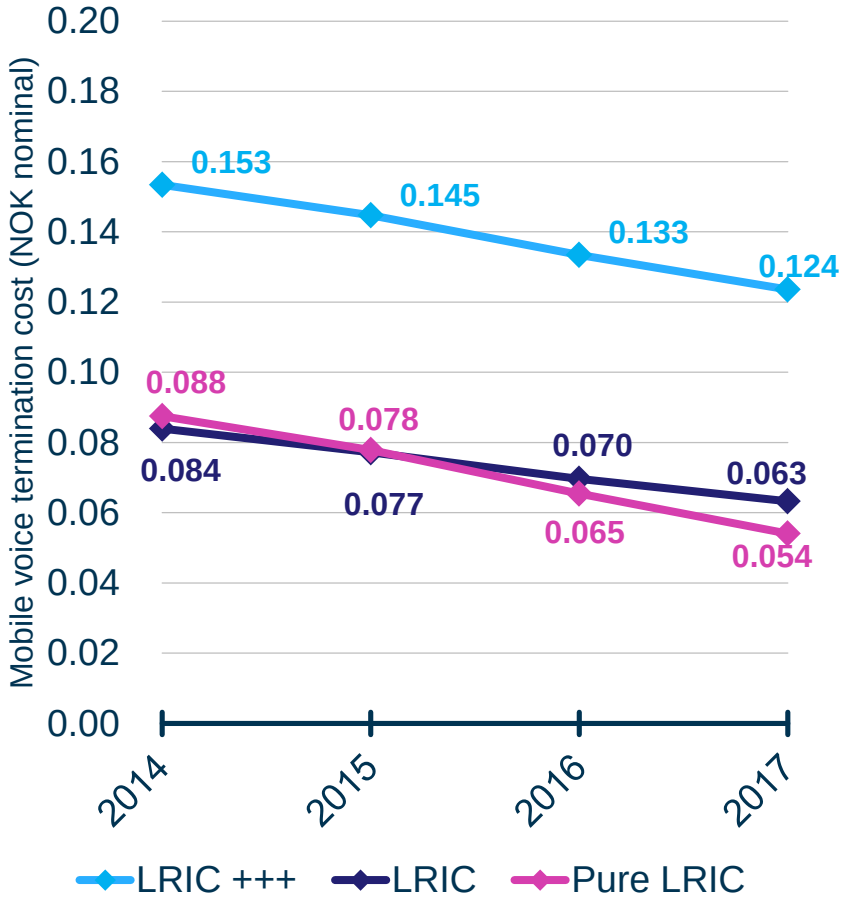
The 2014 Pure LRIC of voice is almost the same as the LRIC, but declines faster over time

Unit costs of voice termination for the generic operator



Indicative

Source: v8D model

amended

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- Electronic versions of these slides will be provided
- The draft model and documentation will be released to industry parties on 1 March 2013
  - mobile network operators will receive their own operator calculation and the generic operator calculation
  - the generic operator calculation will be released on NPT's website
- Industry stakeholders are invited to provide feedback to NPT on the draft model, by **8 April 2013**

amended

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Relevant documents

- Documentation related to the NPT v7.1 model:

  http://www.npt.no/marked/markedsregulering-smp/kostnadsmodeller/lric-mobilnett/_attachment/1804?_ts=1390fd85d55

- Concept paper related to the NPT v7.1 model:

  http://www.npt.no/marked/markedsregulering-smp/kostnadsmodeller/lric-mobilnett/_attachment/1803?_ts=1390fd7ef91

- Documentation related to the NPT v8D model:

  http://www.npt.no/marked/markedsregulering-smp/kostnadsmodeller/lric-mobilnett

- ESA Recommendation on wholesale termination costing:

  http://www.eftasurv.int/media/internal-market/ESAs-Recommendation-on-termination-rates.pdf

- EC Recommendation on wholesale termination costing:

  http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:124:0067:0074:EN:PDF

- The population's use of electronic communications in 2011:

  http://data.norge.no/data/befolkningens-bruk-av-elektroniske-kommunikasjonstjenester-2011

Glossary

- **2G**: Second generation of mobile telephony
- **3G**: Third generation of mobile telephony
- **BSC**: Base station controller
- **BTS**: Base (transmitter) station
- **CK**: Channel kit
- **E1**: 2Mbit/s unit of capacity
- **EC**: European Commission
- **ESA**: EFTA Surveillance Authority
- **GPRS**: General packet radio system
- **HLR**: Home location register
- **HSDPA**: High-speed downlink packet access
- **HSPA**: High-speed packet access
- **HSUPA**: High-speed uplink packet access
- **IP**: Internet Protocol
- **LMA**: Last-mile access
- **LRIC**: Long-run incremental cost
- **LTE**: Long-term evolution
- **Mbit/s**: Megabits per second
- **MGW**: Media gateway
- **MHz**: Megahertz
- **MNO**: Mobile network operator
- **MSC**: Mobile switching centre
- **MSS**: MSC server
- **MT**: Mobile terminated
- **NodeB**: 3G equivalent of a BTS
- **R99**: Release-99
- **RNC**: Radio network controller
- **SIM**: Subscriber identity module
- **SMS**: Short message service
- **STM**: Synchronous transport module
- **TRX**: Transceiver unit
- **UMTS**: Universal Mobile Telecommunications System
- **WACC**: Weighted average cost of capital

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