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WITH A SPECIAL REGARD TO THE SITUATION IN GERMANY

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Digital Dividend – *what's that ?*

- Practical approach:

  The Digital Dividend is understood as the additional spectrum, which will become available as a consequence of the digitalisation and proper establishment of existing analogue services, based on new, efficient transmission and coding technologies

- Origin

  The Digital Dividend results from a development on the technological, not on the political level!

A proper establishment takes into account all societal needs and is based on political decisions.

Transforming the Digital Dividend into consumers benefits (1)

- More broadcasting
- Added value within broadcasting
  ⇨”better broadcasting”
- Additional services other than broadcasting
  ⇨ “better life”

Transforming the Digital Dividend into consumers benefits (2)

- More broadcasting
  - 3 nationwide networks DVB-T (public broadcasters)
  - up to 4 additional networks region-wise/cities (private broadcasters)
  - ⇨ 12 to 30 programmes instead of 3 to 7
- Added value within broadcasting
  - possibly introduction of DVB-T2 including plans for HDTV for some programmes

Transforming the Digital Dividend into consumers benefits (3)

- Provision was made in the economic stimulus package II
- Federal government's broadcasting strategy:
  800 MHz band to be used promptly to provide sparsely populated areas with innovative mobile applications and broadband internet access [approx. 2.5 million households in Germany have no internet access with a minimum of 1 Mbit/s]
- Original idea
  - No later than the end of 2010 efficient broadcasting connections should be available throughout Germany
  - No later than 2014 75% of the households, until 2018 for all households connections with at least 50 Mbit/s should be available
  - Answers to current available dynamic demands due to improved offers
  - High speed radiocommunication high power networks; in addition further construction/expansion of wired high power networks as well as in seemingly non lucrative areas
  - Goal achieved with "mixed resources"

(broadband atlas , http://www.zukunft-breitband.de)

Approach and activities in Germany

Objectives

- Efficient usage
- Guarantee for the development of broadcasting, though win-win-situation
- Quickest possible expansion of the broadband supply in rural areas (IMT)

No special path, but agreed approach in Europe under consideration of the different initial situations of the individual countries

Approach and activities in Germany (2)

Conclusion for the regulation

- Technology neutrality
- Flexibility
  - Regulation should and may business planning of the market participants not prejudice and narrow down
- Planning certainty
  - Regulatory framework should not exclude, rather encourage incentives and secure investments
- Consideration of the different long term initial scenarios in various European countries
  - In the short and medium time frame the different infrastructure conditions in the various countries have to be considered and developed in order to satisfy the existing and developing requirements of the users

DD1: Approach and activities in Germany (1)

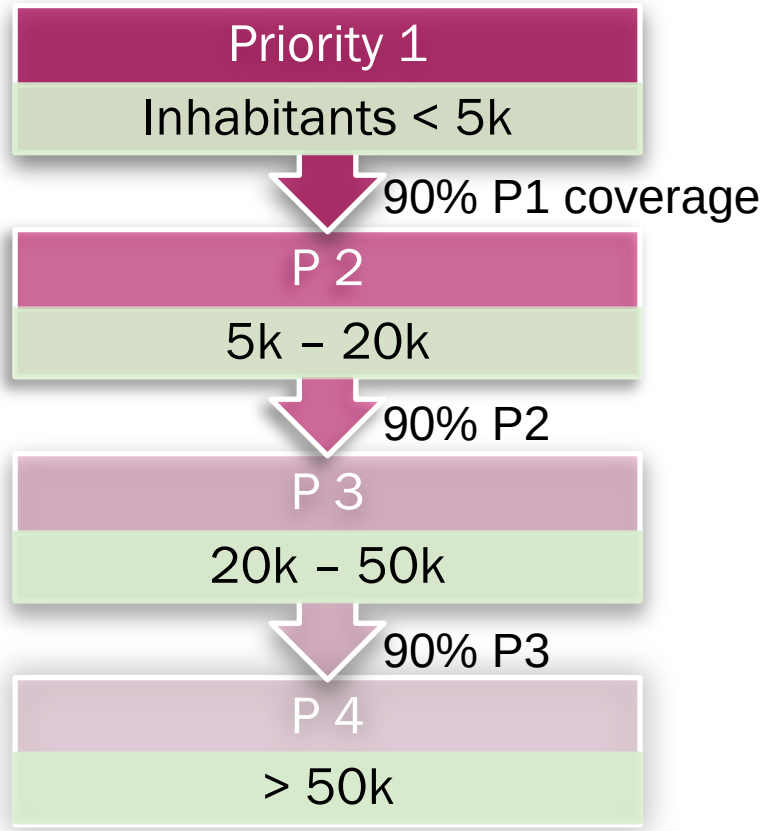
Overall concept for a more flexible use of spectrum

- Liberalisation of existing licenses at 450 MHz (wideband trunked radio [PAMR], 900/1800 MHz (GSM), 2 GHz (IMT/UMTS) and 3.5 GHz (BWA) as quickly as possible
- Award of 358.8 MHz spectrum (decision published 21/10/2009)
  - combining award at 1.8/2/2.6 GHz with award at 800 MHz
  - spectrum auction
  - technology and service neutrality for Electronic Communications Services (ECS; can be used for mobile, fixed or nomadic systems or applications)
  - spectrum cap in the band 800 MHz (2 x 20 MHz, paired)
- Applications for qualification to take part in the auction were to be submitted until 21/01/2010
- Detailed information on all steps may be requested !!

DD1: Approach and activities in Germany (2)

Additional Coverage Obligations

- 4 priority classes
- General requirement for each assignee to meet the obligation with 800 MHz spectrum
- Other technologies are credited
- Degree of coverage:
  90 % of the population by 2016



As of November 2012:

Obligation completely fulfilled in all but one federal state

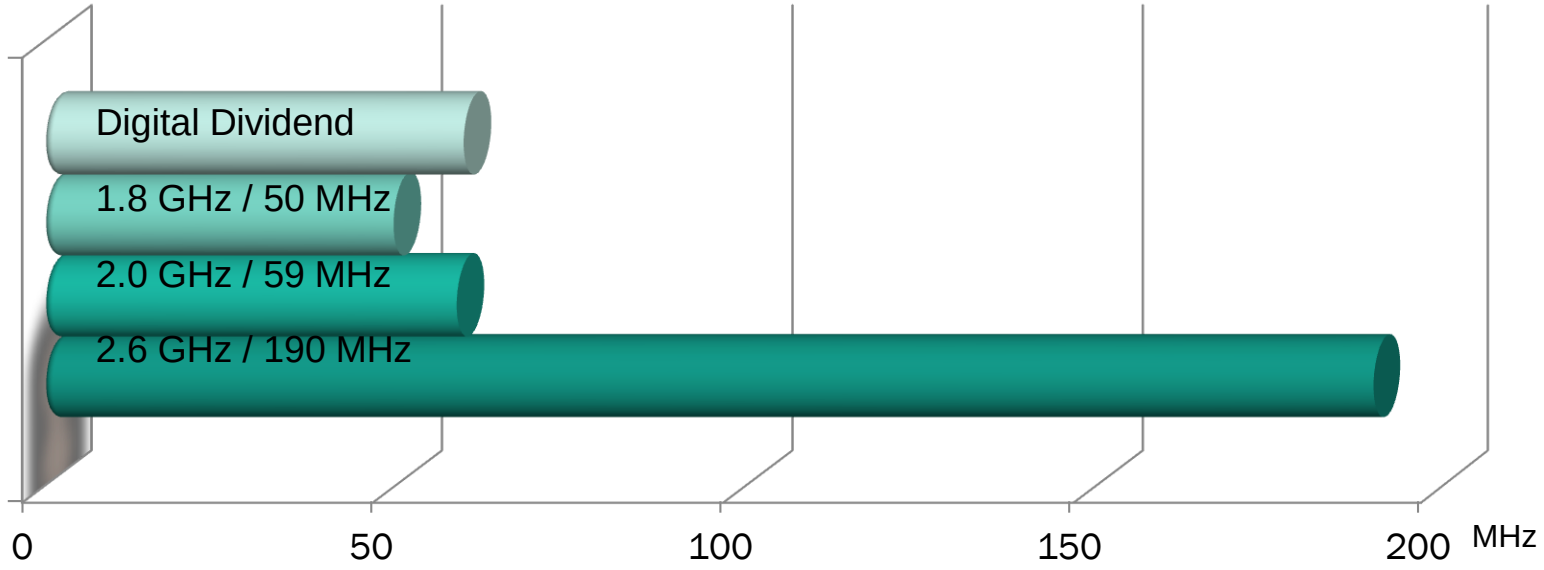
4 years in advance!

DD1: Approach and activities in Germany (3)

- Spectrum cap of 2 x 20 MHz (paired) for the 800 MHz band, account to be taken of the spectrum assigned in the 900 MHz band
- Possibility for each bidder to acquire more than 2 x 5 MHz
- This means for 800 MHz:
  - newcomers: max. 2 x 20 MHz
  - E-Plus / O2: max. 2 x 15 MHz
  - Vodafone / Telekom: max. 2 x 10 MHz

DD1: the auction (1)

- **Open ascending simultaneous multiround auction**
- Start date: 12 April 2010
- Duration: 224 auction rounds
- End of auction: 20 May 2010
- Amount of minimum bids for total spectrum at the beginning: 90 million €



DD1: the auction (2)

Ende der Auktion

Frequenzbereich	Block	Ausstattung	Höchst-bieter	Höchstgebot (€ in Tsd)
0,8 GHz (gepaart)	0,8 GHz A	2x5 MHz konkret	To2 GER	616.595
	0,8 GHz B	2x5 MHz abstrakt	To2 GER	595.760
	0,8 GHz C	2x5 MHz abstrakt	Telekom D	570.849
	0,8 GHz D	2x5 MHz abstrakt	Telekom D	582.949
	0,8 GHz E	2x5 MHz abstrakt	Vodafone	583.005
	0,8 GHz F	2x5 MHz abstrakt	Vodafone	627.317
1,8 GHz (gepaart)	1,8 GHz A	2x5 MHz abstrakt	Telekom D	20.700
	1,8 GHz B	2x5 MHz abstrakt	Telekom D	20.700
	1,8 GHz C	2x5 MHz abstrakt	Telekom D	19.869
	1,8 GHz D	2x5 MHz konkret	E-Plus Grp	21.550
	1,8 GHz E	2x5 MHz konkret	E-Plus Grp	21.536
2,0 GHz (gepaart)	2,0 GHz A	2x4,95 MHz konkret	Vodafone	93.757
	2,0 GHz B	2x4,95 MHz konkret	E-Plus Grp	103.323
	2,0 GHz C	2x4,95 MHz konkret	E-Plus Grp	84.064
	2,0 GHz D	2x4,95 MHz konkret	To2 GER	66.931
2,0 GHz (ungepaart)	2,0 GHz E	1x5 MHz konkret	To2 GER	5.731
	2,0 GHz F	1x14,2 MHz konkret	To2 GER	5.715

Frequenzbereich	Block	Ausstattung	Höchst-bieter	Höchstgebot (€ in Tsd)
2,6 GHz (gepaart)	2,6 GHz A	2x5 MHz abstrakt	Telekom D	19.096
	2,6 GHz B	2x5 MHz abstrakt	Telekom D	19.025
	2,6 GHz C	2x5 MHz abstrakt	To2 GER	17.364
	2,6 GHz D	2x5 MHz abstrakt	To2 GER	17.364
	2,6 GHz E	2x5 MHz abstrakt	Vodafone	18.948
	2,6 GHz F	2x5 MHz abstrakt	Vodafone	19.025
	2,6 GHz G	2x5 MHz abstrakt	Telekom D	19.069
	2,6 GHz H	2x5 MHz abstrakt	Telekom D	19.038
	2,6 GHz I	2x5 MHz abstrakt	To2 GER	18.948
	2,6 GHz J	2x5 MHz abstrakt	E-Plus Grp	18.931
	2,6 GHz K	2x5 MHz abstrakt	E-Plus Grp	17.739
	2,6 GHz L	2x5 MHz abstrakt	To2 GER	17.739
	2,6 GHz M	2x5 MHz abstrakt	Vodafone	17.739
	2,6 GHz N	2x5 MHz abstrakt	Vodafone	17.752
2,6 GHz (ungepaart)	2,6 GHz O	1x5 MHz abstrakt	Vodafone	9.130
	2,6 GHz P	1x5 MHz abstrakt	Vodafone	9.130
	2,6 GHz Q	1x5 MHz abstrakt	Telekom D	8.598
	2,6 GHz R	1x5 MHz abstrakt	Vodafone	8.598
	2,6 GHz S	1x5 MHz abstrakt	Vodafone	9.051
	2,6 GHz T	1x5 MHz abstrakt	Vodafone	9.051
	2,6 GHz U	1x5 MHz abstrakt	E-Plus Grp	8.273
	2,6 GHz V	1x5 MHz abstrakt	To2 GER	8.229
	2,6 GHz W	1x5 MHz abstrakt	To2 GER	8.229
	2,6 GHz X	1x5 MHz abstrakt	E-Plus Grp	8.229

Ausgeschiedene Bieter:

Summe aller gehaltener Höchstgebote (€ in Tsd)	4.384.646
Zahlungsverpflichtung aufgrund zurück-genommener Höchstgebote (€ in Tsd)	0
Summe	4.384.646

DD1: Fields tackled after the auction (1)

Mainly:

- Allotment of the abstract frequency blocks won
- Compatibility issues between German use and use in adjacent countries
- Compatibility issues between mobile and PMSE
- Compatibility issues between mobile and broadcasting services

DD1: Fields tackled after the auction (2)

Allotment of the abstract frequency blocks won

- The abstract frequency blocks won were to be allotted to their highest bidders at the end of the auction with a view to assigning contiguous spectrum
- The successful bidders had the opportunity to agree amongst themselves, within a period of three month of the close of the auction, the spectral position of their blocks in the particular frequency band
- If agreement between the successful bidders was not reached within this period, BNetzA would concentrate initially on the aspect of assigning contiguous spectrum and will allot the abstract blocks won in the bands at 800 MHz and 2.6 GHz
- Done !!!

DD1: Fields tackled after the auction (3)

Compatibility issues between German use and use in adjacent countries

- On the long run, harmonised approach preferred
- Short-term problems to be solved on a bilateral basis
- Common tackling of common issues !!
- Progress made very fast (e. g. in WEDDIP and NEDDIF)
- Agreement with all neighbouring countries, allowing for the application of appropriate field strength values for bilateral co-ordination

DD1: Fields tackled after the auction (4)

Compatibility issues between mobile and PMSE

- In principle, no legal basis for protection of PMSE, but huge political interest
- Frequency allocation issues solved by new concept for PMSE
- Compensation for necessary replacements of equipment approved by German Federal Council
- Rules set

DD1: Fields tackled after the auction (5)

Compatibility issues between mobile and broadcasting services

- Roll-out mobile service has to protect broadcasting
- Three-level-approach
  1. Definition of Block Edge Mask in advance (How to construct devices ?)
  2. Definition of sets of technical characteristics of mobile service stations (after auction, but in advance of each single use of a station)
  3. Corrective steps in case of unforeseen problems
- Re-channeling of existing broadcasting usage on channels 64–66 (done!)
- Refunding approved by German Federal Council
- Holds for all roll-out

DD1: Fields tackled after the auction (6)

Computer-aided definition of sets of technical characteristics

- Individually done per base station
- Transparent algorithm, open to MNOs
- Based on data relevant for frequency planning, also open to MNOs
- Effect: issuing sets of technical characteristics transparent and predictable

Corrective steps in case of unforeseen problems

- Any appropriate measure welcome
- MNOs take self-obligations for selection of measures INDIVIDUAL LY per base station
- Many thousands of base stations in operation in 800 MHz range
- Interference disappeared in 13 cases after adjustments of receiving situation or application of filters (up to December 2014)
- No more cases known!

Introduction of DVB-T2

- Starting point: spring 2016
  - Two bouquets
  - HEVC-coded (h.265)
  - About 35 sites all over Germany
  - Main programs of public providers “on board”
- Transition: by middle of 2019
  - Public providers: three nationwide multiplexes
  - Private providers focus on densely populated areas
  - Some local bouquets also

Freeing the 700 MHz range

- Re-channelling of transmitters to frequencies below 694 MHz when switched over to DVB-T2
- Updated estimation: more than 200 transmitters involved
- Co-ordination without the need for a “planning conference”
- Regional groups (WEDDIP, NEDDIF) structure re-planning in their own capacity
- Different starting points and schedules to be taken into account
- Political decisions towards a common aim not yet taken!
- But partnership already works!

Some aspects of watching terrestrial TV

- No contract needed (=> no hint, whether…)
- No SIM card needed (=> no hint, where…)
- No identifier existing (=> no hint, who…)
- Same set of content for all televiewers
- Many programs free of charge

Upcoming aspects:

- Increasing demand for non-linear content
- Anywhere at any time on any device
- Displays connected to the internet!!!

One aspect of telecommunication markets

In the past:

- Decision on the services provided and on their quality taken by the operators/providers
- Manufacturers to deliver ordered devices
- Users to choose from the diversity of services

Starting from 2007:

- Manufacturers address users´ requirements
- Users press on operators/providers for the provision of requested services

For TV:

- The capabilities of devices require bandwith of feeds

TV Market – Competition of Platforms

An example: a certain market in Central Europe

- 10 programs provide for 95 % of the viewing time of 1 televiewer
- Individual focusing, hence 30 programs needed for 95 % of the viewing time of 95 % of all televiewers

Bandwith per program stream:

- 1080p50 15-20 Mbit/s (H.264) or factor 0.5 (H.265)
- But up to factor 4 for 4k/UHD

Competitive Platform:

- Starting from about xxx Mbit/s at least (xxx = 250?)
  Really possible everywhere?

TV Market – Common technology?

A view to the past:

- A TV set was bought for 10/15/20 years („furniture“)

A view to Europe:

- DVB-T versus DVB-T2
  MPEG2 versus H.264 (versus H.265)

A view to others:

- Some more systems versus DVB-family

A view to the future:

- Even more application situations and device types

Common technology versus amendment of mentality:

Display is the furniture element, electronic modules follow the technical development

TV Market – Where exactly?

An example for a country case

- DTT-only households about 5 %
- Acceptance of DTT 11/12 %

… but highly inhomogeneous!

- Different figures from region to region
- Great discrepancies between cities, towns and rural areas

Also inhomogeneous:

- Coverage areas intended by public or by private providers

TV Market – What exactly?

Increasing demand for non-linear type of content

Broadcasters also benefit

Increasing revenue from non-linear content distribution

All types of displays involved

All locations involved

⇒ Increasing number of application situations

⇒ Increasing number of playout types (?)

⇒ Is the „old“ combination of distribution platforms and application situations still appropriate?

What about convergence?

Great!!!

...if

- broadcasting can remain broadcasting as described
- business cases can be supported
- business incentives can drive the technical development

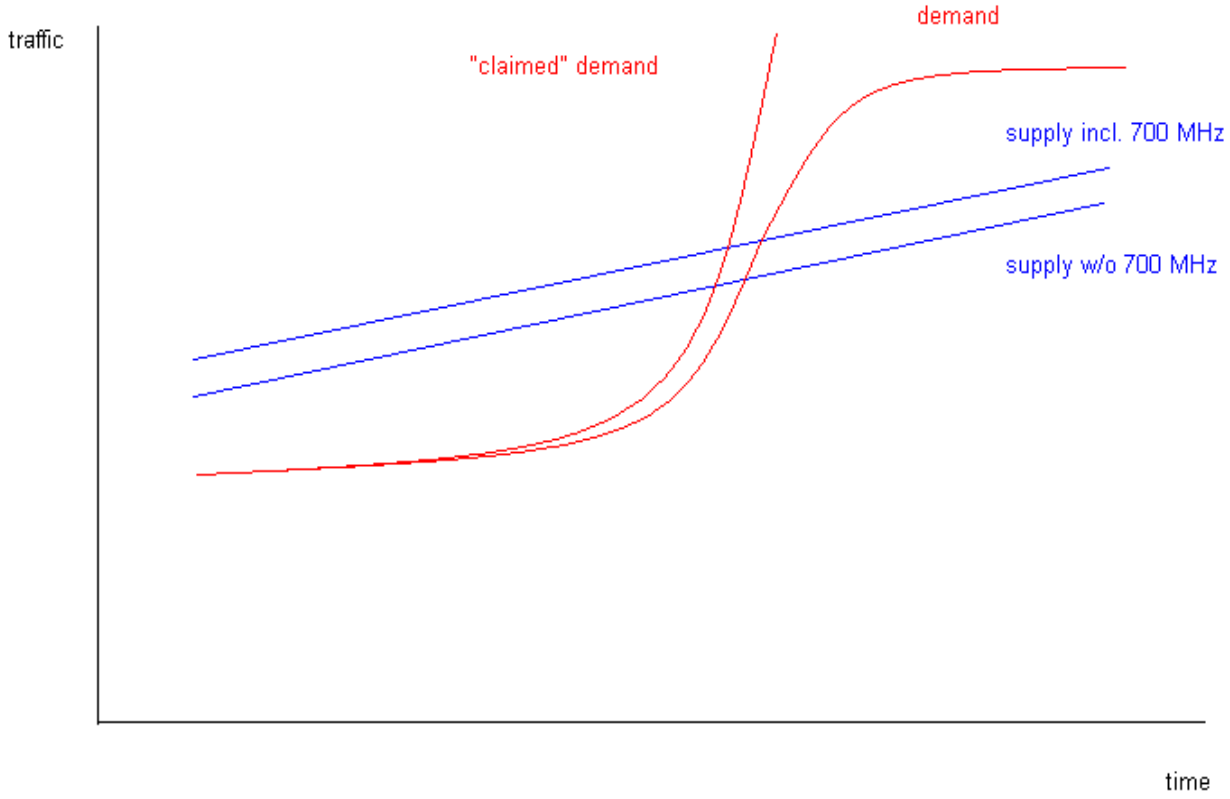
How to achieve this?

Support and enhance the collaboration of mobile operators and broadcasters

The ITU framework

- Starting points: ITU frequency allocation (WRC) and GE-06
  - Binding for administrations versus administrations only, but not for internal way of use or for administration versus operator
- Co-allocation of mobile and broadcasting service
  - Primary rights possible for both of them
  - Existing rights of any (primary) service to be taken into account
  - Severe consequences for any country, depending on the neighbours´ decisions
  - The only way out: collaboration

The framework of claims (1)



The framework of claims (2)

- "Poking" conclusion: Not even with all spectrum made available the networks will cope with the upcoming traffic demand (Spectrum gift doesn´t help!!!)

- Additional means needed:
  - Additional density in network structures
  - Offload
  - Better technical spectrum efficiency
  - ...
- All of them to be done WITHIN a defined spectrum limit anyway!

The framework of claims (3)

- About 30 programmes needed to satisfy recipients to a 95 % extent on a platform (Impacts on the “recipients´” capacity claim)
- For a future fixed reception situation: 8 Mbit/s (720p) to 20 Mbit/s (1080p) per stream needed; even much more in the near future (TV sets with 4k)
- 240 to 600 Mbit/s downstream to large-sized TV sets; terrestrially very difficult even with DVB-T2 and H.264/AVC
- Different conclusion for portable or mobile reception (smaller displays)
- Different feeds for different application situations?

“Poking” conclusion: UHF for large-sized TV at all???

How to “decide” on the resources (1)

- In the analogue world…
  - One “best” technical solution for a certain problem
  - Efficiency increase by harmonisation
  - Harmonised ranges to be separated
  - Hence: definition of (different) radio services
  - Allocation of different frequency ranges to different radio services

Axiom:

“Separation” done based on decoupling on the physical level

How to “decide” on the resources (2)

- And nowadays…
  - For broadcasting, portable and mobile reception situations get more and more important
  - For mobile networks, the transport of media content plays an increasing role
  - Assumption: services get much closer to each other
  - Physical “separation” no longer the most efficient approach

Axiom:

“Separation” to be done based on decoupling on the “logical” level!!!

How to “decide” on the resources (3)

- Approach: Collaborative, not conflicting
  - Conflicting approach: broadcasters will lose slices from their “sausage” (“dividend I”, “dividend II”, …)
  - Better:
    - putting all demands together on one table
    - putting all resources together as well
    - define the framework of a commonly used network structure (no type of technical implementation preferred for the time being, great task for engineers!)

- “Provocation” or not?

In best case, from some future point for ALL UHF-band!!!

How to “decide” on the resources (4)

- To be resolved:
  - Different business cases
  - Different tariffing models
  - Different coverage intentions
  - Different …
- Solutions possible on a regulatory level

OK, understood … and when?

- Starting point: Individual situations
  - Administration A does a transition (duration x years), Administration B follows after y years (duration z years)
    ⇨ Transition losses by efforts to be taken and gains achieved
  - Situation holds for nearly all cases in the past!

Why not taking part in a process long in advance???

Join the party at the earliest point of time possible!!!

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THANK YOU VERY MUCH FOR YOUR ATTENTION!

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