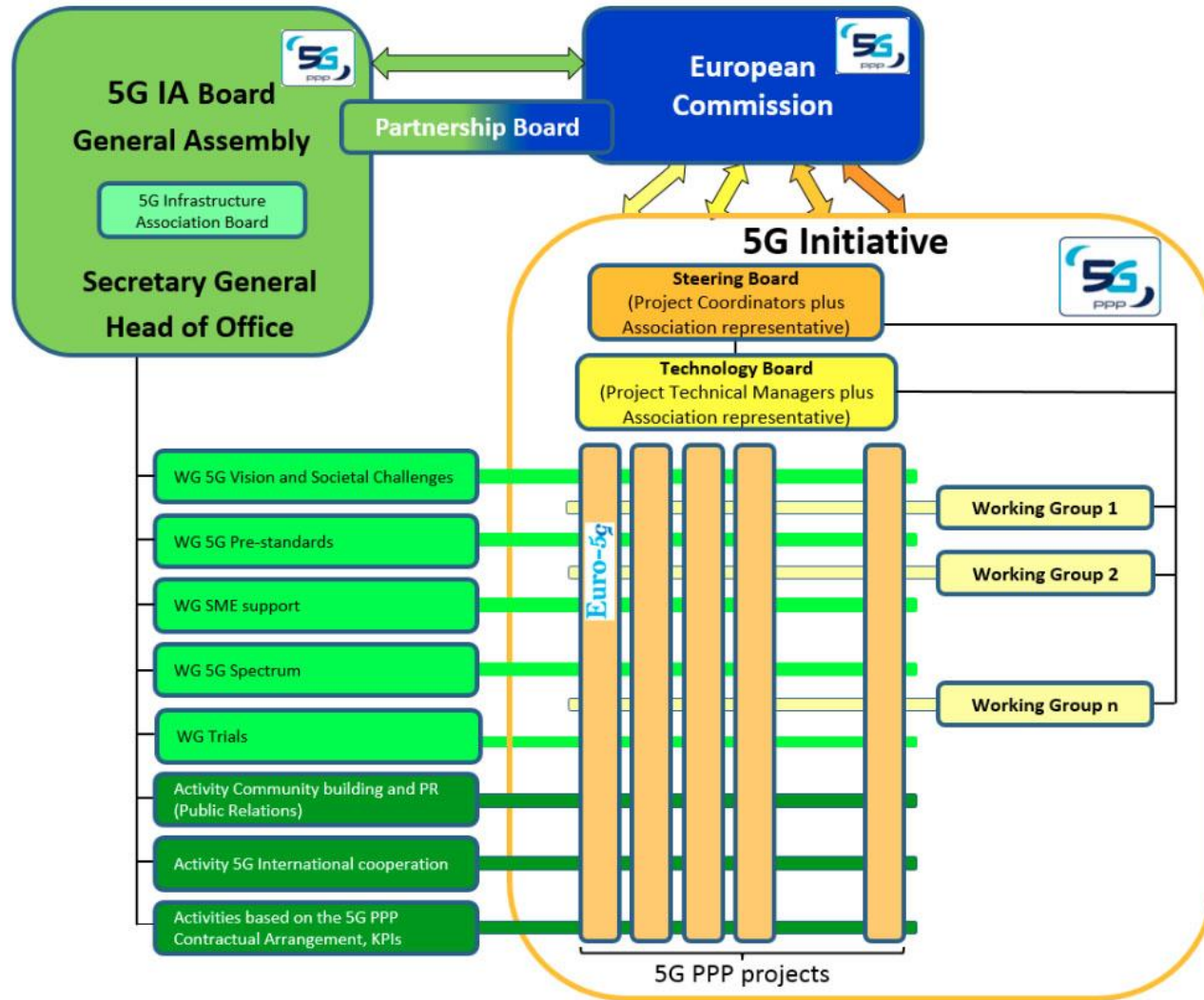# 5G future networks: What ? When ? What for ?... The view from 5G PPP

Jean-Pierre Bienaimé
Secretary General, 5G Infrastructure Association (5G-IA)

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5G PPP Overall Governance

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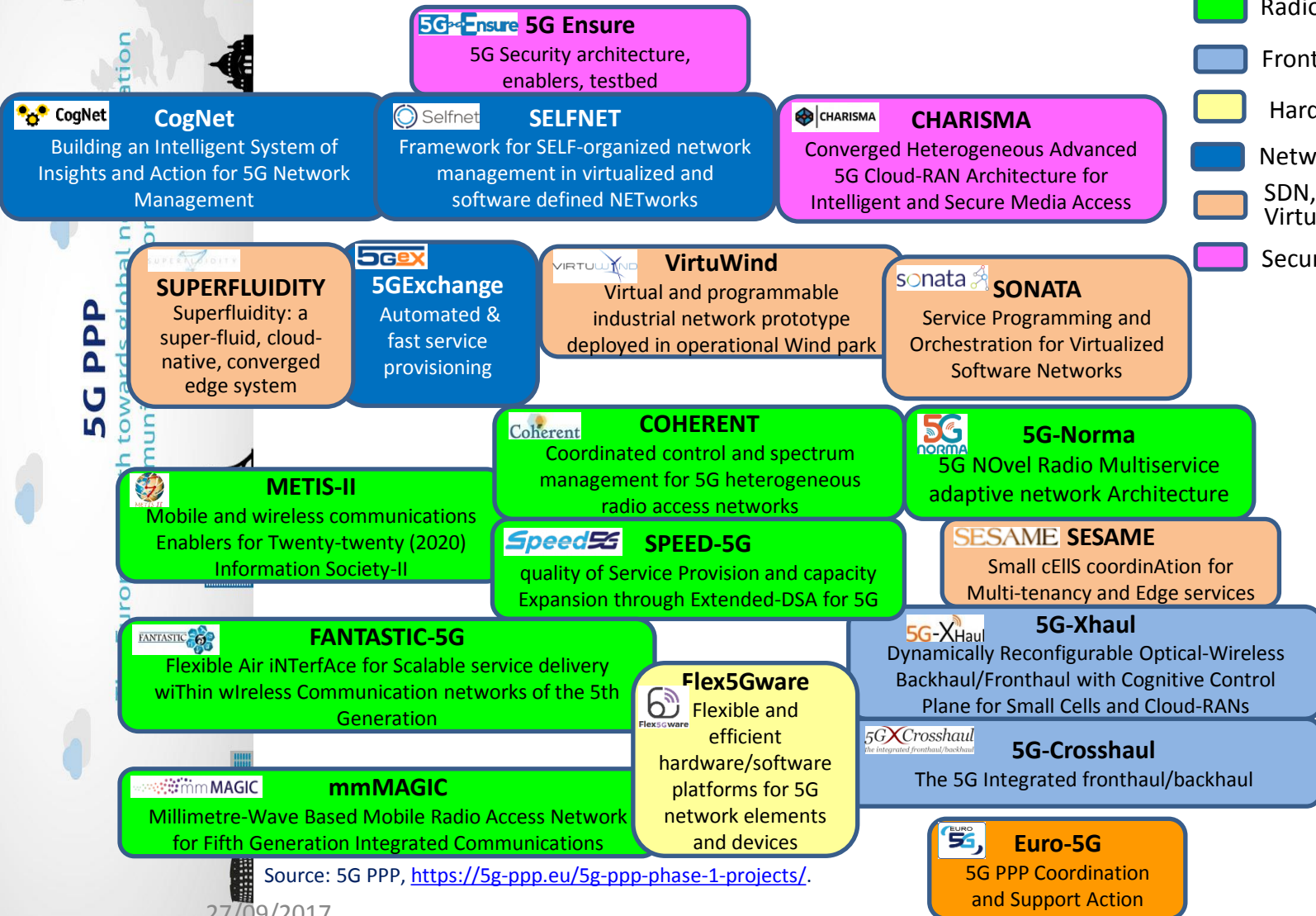# 5G PPP Contractual Arrangement
KPIs for Monitoring

- **Business-related KPIs:**
  - Leverage effect of EU research and innovation funding in terms of private investment in R&D for 5G systems in the order of 5 to 10 times;
  - Target SME participation with an allocation of 20% of the total public funding;
  - Reach a global market share for 5G equipment & services delivered by European headquartered ICT companies above the level of 43 % global market share in communication infrastructure.

- **Performance KPIs:**
  - Providing 1000 times higher wireless area capacity compared to 2010;
  - Reducing the average service creation time cycle from 90 hours to 90 minutes;
  - Very dense deployments to connect over 7 trillion wireless devices serving over 7 billion people;
  - Secure & reliable Internet with a "zero perceived" downtime for services provision.

- **Societal KPIs:**
  - Enabling advanced User controlled privacy;
  - Reduction of energy consumption per service up to 90 % (vs 2010);
  - European availability of a competitive offer for 5G systems and technologies;
  - New economically-viable services of high societal value like U-HDTV and M2M applications;
  - Development & availability of 5G skills curricula in partnership with the EIT.

Source: 5G PPP Contractual Arrangement.

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Horizon 2020 5G PPP
19 Phase 1 projects on-going

5G IA

Legend:
- Radio-related cluster (green)
- Fronthaul/Backhaul (blue-grey)
- Hardware implementation (yellow)
- Network automation (dark blue)
- SDN, NFV, Cloud and Virtualisation (orange)
- Security (magenta)

5G Ensure
5G Security architecture, enablers, testbed

CogNet
Building an Intelligent System of Insights and Action for 5G Network Management

SELFNET
Framework for SELF-organized network management in virtualized and software defined NETworks

CHARISMA
Converged Heterogeneous Advanced 5G Cloud-RAN Architecture for Intelligent and Secure Media Access

SUPERFLUIDITY
Superfluidity: a super-fluid, cloud-native, converged edge system

5GExchange
Automated & fast service provisioning

VirtuWind
Virtual and programmable industrial network prototype deployed in operational Wind park

SONATA
Service Programming and Orchestration for Virtualized Software Networks

COHERENT
Coordinated control and spectrum management for 5G heterogeneous radio access networks

5G-Norma
5G NOvel Radio Multiservice adaptive network Architecture

METIS-II
Mobile and wireless communications Enablers for Twenty-twenty (2020) Information Society-II

SPEED-5G
quality of Service Provision and capacity Expansion through Extended-DSA for 5G

SESAME
Small cEllS coordinAtion for Multi-tenancy and Edge services

FANTASTIC-5G
Flexible Air iNTerfAce for Scalable service delivery wiThin wIreless Communication networks of the 5th Generation

Flex5Gware
Flexible and efficient hardware/software platforms for 5G network elements and devices

5G-Xhaul
Dynamically Reconfigurable Optical-Wireless Backhaul/Fronthaul with Cognitive Control Plane for Small Cells and Cloud-RANs

5G-Crosshaul
The 5G Integrated fronthaul/backhaul

mmMAGIC
Millimetre-Wave Based Mobile Radio Access Network for Fifth Generation Integrated Communications

Euro-5G
5G PPP Coordination and Support Action

Source: 5G PPP, https://5g-ppp.eu/5g-ppp-phase-1-projects/.

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5G PPP leading innovations towards 5G

- **Thousands of researchers and developers across Europe** are working on innovative solutions for the definition of 5G

- **5G PPP Phase 1 main achievements:**
  - 5G System design & Evaluation aspects
  - 5G Air interface innovations
  - Network management & Security innovations
  - Virtualization & Service deployment innovations

- **5G PPP Projects are building pre-standards consensus** and provide contributions to standardization as well, in order to strengthen Europe's influence

Where do we stand with 5G requirements (1)? 3rd Cross 5G PPP Workshop February 2017

KPI	Requirement	METIS-II performance	Key contributor
C-Plane latency	< 10 ms	7.125 ms	RRC Connected Inactive, reduction of processing time in BS and UE
U-Plane latency	< 1ms	0.763 ms	Shortening of TTI, reduction of processing time in BS and UE
mMTC energy efficiency	> 10 years on a single 5 Wh battery	> 10 years on a single 5 Wh battery	Extension of DRX, C-Plane latency reduction, deep sleep energy conservation features
Peak data rates	> 20/10 Gbps for DL/UL	21.7/12.4 Gbps for DL/UL	MIMO spatial multiplexing (for lower frequencies), exploitation of mmW bands
Mobility interruption time	0 ms	0 ms	Multi-connectivity + make-before-brake

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Where do we stand with 5G requirements (2)? 3rd Cross 5G PPP Workshop February 2017

KPI	Requirements	METIS-II performance	Comments
User throughput (use case 1, UC2 and UC3)	UC1: 300 Mbps UC2: up to 5 Gbps UC3: 50/25 Mbps for DL/UL	UC1: 1 Gbps+ UC2: up to 7.85 Gbps UC3: 50/25 Mbps for DL/UL	Only DL values for UC1 and UC2 Different methodology applied for UC3 evaluation
mMTC device density (UC4)	> 1 mln/km^2	4 mln/km^2	Depends heavily on the traffic/report periodicity of mMTC devices. 1 upload of 1000 bits every 100 s was used in METIS-II
Reliability (UC5)	99.999% at 50/1000m for urban/highway	99.999% at 45/150m for urban/highway	For highway scenario, requirements seems very difficult to meet (revision needed?)
Network energy efficiency (UC1, UC3)	Should follow (at least) capacity improvement	For the capacity x1000, network energy efficiency improvements of 350-7500 were reported	Evaluation done only for Dense Urban environment. Savings depend on the load level in LTE-A/5G network

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EUCNC 2017 - Oulu

5G-PPP SESAME - OTE Greece

5G-Xhaul - University of Thessaly

- **Successful edition of EUCNC 2017** in June 2017, with more than 650 participants, where many 5G PPP Phase 1 projects had a booth in the exhibition area and participated in various workshops, whereas 5G-IA Representatives delivered presentations on topics such as spectrum, connected cars, security and 5G PPP collaboration.
- EUCNC 2017 was the occasion of the **official launch of the 5G PPP Phase 2 Projects,** with the presentations by each of the 23 new projects,

Start of 5G PPP Phase 2

5G IA

			2017							2018													2019													2020								
			June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug
			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36	M37	M38	M39
ICT 7	CSA	To-Euro-5G																																							
ICT 7	CSA		Global 5G.org																																					
ICT 7	R&I	5G Car																																							
ICT 7	R&I	5G ESSENCE																																							
ICT 7	R&I	5G TRANSFORMER																																							
ICT 7	R&I		5G-Monarch																																					
ICT 7	R&I	5G-PICTURE																																							
ICT 7	R&I	5G-Xcast																																							
ICT 7	R&I	BlueSpace																																							
ICT 7	R&I	IoRL																																							
ICT 7	R&I	METRO-HAUL																																							
ICT 7	R&I	NRG-5																																							
ICT 7	R&I	ONE5G																																							
ICT 7	R&I	SAT5G																																							
ICT 7	R&I	SLICENET																																							
ICT 8	I	5G-MEDIA																																							
ICT 8	I			5G-PHOS																																					
ICT 8	I	5GTANGO																																							
ICT 8	I	MATILDA																																							
ICT 8	I	NGPaaS																																							
ICT 8	I	5G-Cities																																							

5G PPP

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5G innovations for new business opportunities
New 5G PPP/5G IA white paper, MWC'17 - 28 February, 2017

5G-IA White Paper: Recommendations

➔ **Standardization** is essential for realizing 5G promises
➔ **Spectrum availability** is key for 5G development and deployments
➔ **Cost-efficient deployment** strategies are needed
➔ **New business opportunities** are expected to emerge from 5G, enabled by 5G PPP innovations
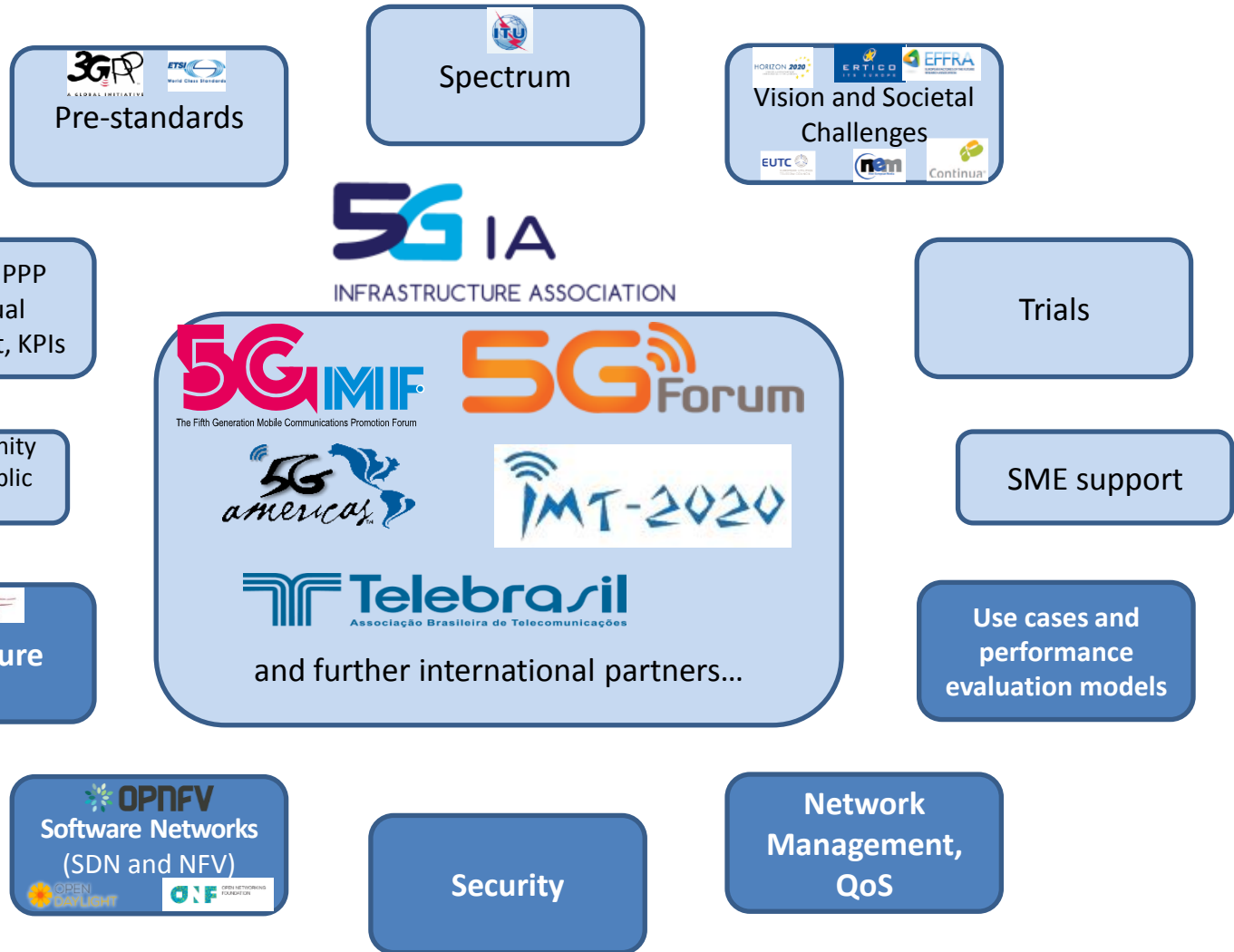
5G Pan-EU Trials Roadmap Version 1.0
Four Main Pillars

- **Expanding the work initiated by Industry in the context of the 5G Manifesto and by the European Commission in the EC 5G Action Plan (5G AP)**

→ → → → →

→ → → → →

- Building Europe 5G readiness through **5G Private Trials**

- **5G for Vertical Industries** - Building the case through Pilots

- **5G for UEFA EURO 2020** - An opportunity for a Pan-European Showcase Event

- 5G **Trials Cities**

5G PPP

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5G PPP supports international cooperation towards consensus building

Source: 5G Infrastructure Association.

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5G Vision...

- More than other regions in the world, **Europe's vision for 5G is very ambitious**, aiming at a deep ecosystem transformation

- **5G will be a full connectivity platform**, and not only an improved air interface, even aggregated with other technologies

  ➔ *DT: WE NEED A JOINT INDUSTRY PUSH FOR A MUCH MORE INNOVATIVE 5G SYSTEM ARCHITECTURE IN ORDER TO BE ABLE TO DELIVER ON THE 5G VISION !*

- Let's implement 5G PPP Phase 2 projects, prepare Phase 3, towards **5G commercial deployments and 5G Evolution...**

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Thank you for your attention!

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