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National security debates erupted since the 3G era when mobile broadband Internet access began to enable previously unimaginable applications. Competition intensifies as we step into 5G. During a decade of paradigm shifts, ambitious superpowers, critical supply chain vendors and research institutes keep seeking influence, most notably through technological standardization.

In 1998, the 3rd Generation Partnership Project (3GPP) started to develop protocols for mobile telecommunications with the goal of establishing a 3G mobile phone system based on the 2G GSM standard. Interest entities send delegates to 3GPP meetings to discuss and vote for technologies to become standards. These details are documented in a TDoc "Temporary Document."

Among these entities are a variety of government agencies, federally funded research institutes and companies that employ a variety of strategies to advance national interests and meet national security requirements.

Apex Standards specialists examine these governmental activities using 3GPP TDoc and meeting registration data. Our observations follow.

The U.S. government has the most direct participation by agency counts including NIST, FCC, DoD, DoT, NTIA, NSA and DHS. While FCC and DoT have obvious regulatory interests in spectrums and V2X respectively, DoD and intelligence agencies tend to rely on satellite and aerospace companies for uninterrupted satellite connectivity in the Non-Terrestrial Network (NTN) and security domains as provided by Ligado, Hughes and MITRE. The trend becomes clear when civilian 5G calls for spectrum slicing and sharing from the sub-6GHz C-Band that are also used by DoD for military radars, raising security concerns. In comparison to Asian teams, U.S. agencies and companies have fewer delegates. Despite a tiny size, FirstNet (6 Del.) co-sources 1514 TDocs, indicating inter-agency partnership, so do NTAC and CISA. NIST and Harris, however, sole-source a higher portion of TDocs, suggesting their specialty on standards and mission critical technologies.

Intelligence-wise, U.K. NCSC, NTAC and Ofcom contribute the most TDocs to the S3 Working Group (Security). NCSC, in particular, sole-sources most TDocs that serve as the focal point for S3 debates.

As 5G promises high bandwidth and low latency, it also pledges wide coverage beyond the reach of terrestrial networks (TN) where base station deployment is either costly (mountains) or impossible (oceans). Low earth orbit satellite connectivity fills the gap. ESA, Eutelsat, Thales and Airbus in E.U. serve the most TDocs to NTN, followed by U.S. ones.

Nation / Region	Interest	Type	Entity	# Del.	# TDoc	# Imp. TDoc	% Imp. TDoc	Emphasis Working Grp
U.S.	Regulatory	Government	First Responder Network Authority (FirstNet)	6	1514	553	37%	C1, S6, R2
U.S.	Regulatory	Government	Dept of Commerce - Natl Institute of Standards and Technology (NIST)	8	1018	294	29%	R5, C1, S3
U.S.	Regulatory	Government	Dept of Commerce - Natl Telecommunications and Information Administration (NTIA)	2	5	3	60%	R2, S3
U.S.	National Interest	Research	Dept of Energy - Idaho Natl Laboratory	4	43	9	21%	R1
U.S.	Regulatory	Government	Dept of Transportation (DoT)	1	1	1	100%	R1
U.S.	Regulatory	Government	Natl Transportation Safety Board (NTSB)	1	0	0		S6
U.S.	Regulatory	Government	Federal Aviation Administration (FAA)	2	0	0		R2, R3, R5
U.S.	Regulatory	Government	Federal Communications Commission (FCC)	3	2	1	50%	R4, R1, R5
U.S.	Intelligence	Government	Secret Services - Natl Threat Assessment Center (NTAC)	1	84	35	42%	S3
U.S.	Intelligence	Government	Dept of Defense (DoD) - Chief Information Office (CIO)	2	4	2	50%	S3
U.S.	Intelligence	Government	Dept of Defense (DoD) - Cybersecurity Research Laboratory (CRL)	3	0	0		S3
U.S.	Intelligence	Government	Dept of Defense (DoD) - Naval Research Laboratory (NRL)	1	0	0		S3
U.S.	Intelligence	Government	Dept of Defense (DoD) - Natl Geospatial Intelligence Agency (NGIA)	1	0	0		R2
U.S.	Cybersecurity	Government	Dept of Defense (DoD) - Natl Security Agency (NSA)	2	7	3	43%	S3
U.S.	Satellite	Government	Natl Aeronautics and Space Administration (NASA)	1	0	0		R2, S6, R1
U.S.	Intelligence	Government	Dept of Homeland Security - Cybersecurity and Infrastructure Security Agency (CISA)	0	163	57	35%	R2, S2, S1
U.S.	Intelligence	Government	Dept of Homeland Security - Office of Emergency Communications (OEC)	0	9	2	22%	S2, C1
U.S.	Intelligence	Government	Dept of Homeland Security - Natl Communications System (NCS)	0	7	1	14%	S3
U.S.	Security	Contractor	MITRE	7	42	23	55%	S3, S6, R2
U.S.	Mission Critical	Contractor	Lockheed Martin	2	6	4	67%	R2, R1
U.S.	Mission Critical	Contractor	Harris	5	902	397	44%	C1, S6, S1
U.S.	Satellite	Contractor	Globalstar	1	124	78	63%	R4, R5
U.S.	Satellite	Contractor	Intelsat	1	39	18	46%	R4, R1, S2
U.S.	Satellite	Contractor	Iridium Satellite Communications	1	5	2	40%	R2, S1, R1
U.S.	Satellite	Contractor	Starlink (SpaceX)	0	3	1	33%	R1, S2, R4
U.S.	Satellite	Contractor	EchoStar	2	22	13	59%	R4, R2, R1
U.S.	Satellite	Contractor	Hughes Networks	14	156	62	40%	R1, R4, S2
U.S.	Satellite	Contractor	Ligado Networks	11	402	285	71%	R4, R5, S2
Canada	Regulatory	Government	Department of Public Safety and Emergency Preparedness	1	41	18	44%	S3
U.K.	Intelligence	Government	Natl Cyber Security Centre (NCSC)	4	266	168	63%	S3, R2
U.K.	Intelligence	Government	Natl Technical Assistance Centre (NTAC)	5	84	39	46%	S3, C1
U.K.	Regulatory	Government	Radiocommunications Agency (Ofcom)	12	33	15	45%	S3, R4
U.K.	Satellite	Contractor	Inmarsat	1	41	22	54%	R4, S2
E.U.	Satellite	Contractor	European Union Agency for the Space Programme (EUSPA)	1	0	0		R2
E.U.	Satellite	Contractor	European Global Navigation Satellite System Agency (GNSS)	1	0	0		R2
E.U.	Satellite	Contractor	European Space Agency (ESA)	3	249	105	42%	S1, R2, R1
E.U.	Satellite	Contractor	Eutelsat	2	86	37	43%	R2, R1, S2
E.U.	Satellite	Contractor	Airbus Defence and Space	4	714	368	52%	S6, C1, R4
E.U.	Satellite	Contractor	Thales	22	1578	697	44%	R1, S2, R3
Sweden	Intelligence	Government	Natl Defense Radio Establishment (NDRE)	1	23	14	61%	S3
Germany	Regulatory	Government	Federal Ministry for Economic Affairs and Energy (BMWi)	4	149	67	45%	S1, S6, R2
Germany	Security	Government	German Agency for Digital Radio of Security Authorities and Organizations (BDBOS)	3	375	169	45%	S6, S1
Germany	National Interest	Research	Fraunhofer	64	1569	705	45%	S4, R1, R4
France	Regulatory	Government	Ministère de l'Économie et des Finances	1	137	51	37%	S3, C1
France	Regulatory	Government	Ministère de l'Intérieur	2	41	20	49%	S1, S6, S2
France	Mission Critical	Contractor	Union Internationale des Chemins de fer (UIC, International Union of Railways)	1	557	216	39%	S1, S6, R2
Netherlands	Security	Government	The Police of the Netherlands	1	272	122	45%	S6, S1
Luxembourg	Satellite	Contractor	Société Européenne des Satellites (SES)	4	65	39	60%	S2, R4
Switzerland	Mission Critical	Contractor	Schweizerische Bundesbahnen (SBB/CFF/FFS, Swiss Federal Railways)	1	8	4	50%	S1
Russia	Cryptography	Research	Научно-производственная компания Криптонит (JSRPC Kryptonite)	4	4	3	75%	S3, S2
Israel	National Interest	Research	Israeli Association of Electronics & Software Industries (IAESI)	31	71	30	42%	R3, S2, R1
China	National Interest	Research	China Academy of Telecommunications Technology (CATT / Datang)	139	16778	6367	38%	R1, R2, R4
China	National Interest	Research	China Academy of Information and Communications Technology (CAICT)	23	1308	618	47%	R5, R4, R1
China	National Interest	Research	China Academy of Telecommunication Research (CATR)	87	1139	478	42%	R4, R1, S2
China	National Interest	Research	Zhejiang Laboratory	4	24	1	4%	R1
China	National Interest	Research	Applied Science and Technology Research Institute, Hong Kong (ASTRI)	25	129	68	53%	R1, R4
South Korea	National Interest	Research	Electronics and Telecommunications Research Institute (ETRI)	146	2119	634	30%	S2, R1, S1
South Korea	Mission Critical	Research	Korea Railroad Research Institute (KRRI)	4	124	57	46%	S1, R1
South Korea	Regulatory	Government	Korea Testing Laboratory (KTL)	13	271	89	33%	R5, S1
South Korea	Regulatory	Government	Mobile Technology Convergence Center (MTCC)	1	63	28	44%	R5
Japan	National Interest	Research	Advanced Telecommunications Research Institute (ATR)	6	16	7	44%	S2
Japan	National Interest	Research	Natl Institute of Information and Communications Technology (NICT)	7	92	33	36%	S2, R1
Taiwan	National Interest	Research	Industrial Technology Research Institute (ITRI)	101	1038	304	29%	R1, R2, S2
Taiwan	National Interest	Research	Institute for Information Industry (III)	57	188	37	20%	R1, S2
Taiwan	National Interest	Research	Taiwan Association of Information and Communication Standards (TAICS)	1	4	2	50%	S2
India	National Interest	Research	Centre of Excellence in Wireless Technology (CEWiT)	35	289	107	37%	R1, R2, R4

Data collection: we analyze 5G related TDoc submissions (Release 15-17) dated between Jan 1, 2016 and Jul 31, 2021. The TDocs are sole sourced or co-sourced by the government agencies, federally funded or state-owned organizations under analysis. The column (# Del.) accounts for the unique number of person names delegated by each agency or organization during the same period. The column (Imp. TDoc) denotes the number of important 5G TDocs that are "Noted", "Approved", "Agreed", "Endorsed" by a 3GPP Chairman or Vice Chairman, or, "Referenced" by future TDocs.

In Germany, BDBOS has a heavy emphasis in the S6 Working Group (Mission Critical). Fraunhofer maintains a stronghold in S4 (Codec) while gaining ground in R1 (Physical Layer) and R4 (Measurements).

China looks to be gaining influence on both the size of the delegation teams and the number of TDocs. CATT, CATR, and CAICT (previously CATR) outweigh these influence metrics in all major working groups, indicating the nation's aim to take control over 5G standards.

South Korea's ETRI leads in terms of delegation team size (146 Del., 2119 TDocs), followed by China's CATT (139 Del., 16778 TDocs), Taiwan's ITRI (101 Del., 1038 TDocs), China's CATR (87 Del., 1139 TDocs), and Germany's Fraunhofer (64 Del., 1569 TDocs). These national research institutes therefore top the list. Fraunhofer (45%) is the leader in terms of (%) important TDocs, followed by CATR (42%), CATT (38%), CEWiT (37%), NICT (36%), ETRI (30%) and ITRI (29%).

Global Strategic Positions

Geopolitically, governments and related entities in western countries that rely on the capital market for infrastructure provision have smaller teams and fewer directly contributed TDocs, with a greater emphasis on S3 (Security) and S6 (Mission Critical) that appear sensitive to national security protection.

Asia's government-supported research institutes have significantly larger teams and much more TDocs. This could be because their manufacturing capacity and supply chains are heavily located along the Info. & Comm. Tech. (ICT) vertical, requiring them to conform to—or even better, define—technical standards across Radio Access Network (RAN) working groups. When it comes to boosting national economic production through improved R&D competitive advantage and standard-related IPR positioning, it pays to be a standard setter rather than a follower. ∎