DC 2024

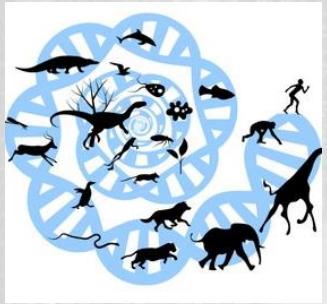
Combined Rates

Motivation

Combine numbers

Each experiment was providing their own numbers

We need to have the sum up – global view of those numbers and same units



Up to date

Numbers were fluctuating in between presentations

Keep a one document up to date

Identify limits

Numbers need to be compared with capacities

Network capacities need to be compared with the plans

DC24 Planning per experiment

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	12/02/2024	13/02/2024	14/02/2024	15/02/2024	16/02/2024	17/02/2024	18/02/2024
ALICE	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1
ATLAS	T0 → T1	T0 → T1	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2
CMS	T0 → T1	T0 → T1	T0 → T1 → T2	T1 → T2	T1 ↔ T2	T1 ↔ T2	T1 ↔ T2
LHCb		T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1
DUNE	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2
Belle II	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1
SUMMARY							
T0 exports minimal rates (ALICE+ATLAS+LHCB+CMS)	529.7 Gbps	650.3 Gbps	650.3 Gbps	650.3 Gbps	650.3 Gbps	650.3 Gbps	650.3 Gbps
T0 exports (DUNE + Belle II)							

	Monday	Tuesday	Wednesday	Thursday	Friday	
	19/02/2024	20/02/2024	21/02/2024	22/02/2024	23/02/2024	yellow: "reduced minimal" (only T0 export)
ALICE	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1	blue: minimal scenario
ATLAS	T0 ↔ T1 ↔ T2	T0 ↔ T1 ↔ T2	T0 ↔ T1 ↔ T2	T0 ↔ T1 ↔ T2	T0 ↔ T1 ↔ T2	red: flexible scenario
CMS	AAA T1 → T2	T0 → T1 ↔ T2	T0 → T1 ↔ T2	T0 → T1 ↔ T2	T0 → T1 ↔ T2	
LHCb	T0 → T1	T1 Tape Recall	T1 Tape Recall	T1 Tape Recall	T1 Tape Recall	
DUNE	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	T0 → T1 → T2	
Belle II	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 → T1	T0 == SURF , T1 == FNAL, T2 == Storage sites
SUMMARY						
T0 exports high rates (ALICE+ATLAS+LHCB+CMS)	449.56 Gbps	895.56 Gbps	895.56 Gbps	895.56 Gbps	895.56 Gbps	

DC24 Planning per experiment | Tier0-Tier1s (Minimal rates) | Tier-0-Tier1s (Higher rates) | Tier1s to Tier1s rates | Transatlantic links | Tier2s expectations

Workbook Statistics

Idea: Add summary numbers

- T0 exports
- Total non LHCONE Tier1s traffic + T0 exports
- Transatlantic traffic

Tier0-Tier1s (Minimal rates)

NOTICE: These are link rates from/to CERN-PROD and the different Tier1s																			
[1] https://twiki.cern.ch/twiki/bin/view/LHCOPN/OverallNetworkMaps																			
[2] MONIT link: https://monit-grafana-open.cern.ch/d/000000523/home?orgId=16&viewPanel=1																			
CERN-PROD source (Write rates)	TW-ASGC	RRC-KI	ES-PIC	DE-KIT	FR-CCIN2P3	IT-INFN-CNAF	UK-RAL	NDGF (CH-LHEP)	NDGF (Scandinavia)	NL-T1(Nikhef, SA	PL-NCBJ	CN-IHEP	RRC-JINR	CA-TRIUMF	US-BNL	US-FNAL	RC-KISTI	Sum total	Sum total GB/s
ALICE				5	4	7	1		3	1	0	0	0	0	0	0	2	23	2.875
ATLAS (injected + production transfers)	0	0.11	11.58	33.76	40.12	24.21	40.06	0	1.73	15.81	0	0	0	26.38	63.28	0	0	257.04	32.13
CMS	0	0	10	26	27	34	20	0	0	0	0	0	29	0	0	104		250	31.25
LHCb	0	0	4.38	23.54	13.14	17.61	34.02	0	0	9.88	8.76	8.93	0	0	0	0		120.26	15.0325
Total	0	0.11	25.96	88.3	84.26	82.82	95.08	0	4.73	26.69	8.76	8.93	29	26.38	63.28	104	2	650.3	81.2875
Network Capacity[1]	10Gbps	100Gbps	100Gbps	200Gbps	100Gbps	200Gbps	200Gbps	100Gbps	100Gbps	400Gbps	20Gbps	20Gbps	100Gbps	100Gbps	200Gbps	200Gbps	40Gbps		
DUNE																			
Belle II (from KEK via LHCONE)	0	0		1.1	1.7	2.2	0	0	0	0	0	0	0	0	3.3	0	0	8.3	1.0375
CERN-PROD destination (Read rates)	TW-ASGC	RRC-KI	ES-PIC	DE-KIT	FR-CCIN2P3	IT-INFN-CNAF	UK-RAL	NDGF (CH-LHEP)	NDGF (Scandinavia)	NL-T1(Nikhef, SA	PL-NCBJ	CN-IHEP	RRC-JINR	CA-TRIUMF	US-BNL	US-FNAL	RC-KISTI	Sum total Gb/s	Sum total GB/s
ALICE				n/a	n/a	n/a	n/a		n/a	n/a							n/a	0	0
ATLAS (injected + production transfers)	0	0.08	0.27	1.14	1.06	0.61	1.48	0	2.35	0.54	0	0	0	1.01	1.84	0	0	10.38	1.2975
CMS	0	0	1.3	3.2	3.3	4.2	2.5	0	0	0	0	0	3.6	0	0	13		31.1	3.8875
LHCb	0	0	3.44	14.26	10.31	13.74	20.62	0	0	6.87	7.65	5.41	0	0	0	0	0	82.3	10.2875
Total	0	0.08	5.01	18.6	14.67	18.55	24.6	0	2.35	7.41	7.65	5.41	3.6	1.01	1.84	13	0	123.78	15.4725
Network Capacity[1]	10Gbps	100Gbps	100Gbps	200Gbps	100Gbps	200Gbps	200Gbps	100Gbps	100Gbps	400Gbps	20Gbps	20Gbps	100Gbps	100Gbps	200Gbps	200Gbps	40Gbps		
DUNE			1				1			1					1	1			
Belle II																			

DC24 Planning per experiment | **Tier0-Tier1s (Minimal rates)** | Tier-0-Tier1s (Higher rates) | Tier1s to Tier1s rates | Transatlantic links | Tier2s expectations

Experiments sum up (same language/same units ☺)
- Pending to include DUNE and Belle II on it!
- Network capacity and network monitoring links

Tier-0-Tier1s (Higher rates)

NOTICE: These are link rates from/to CERN-PROD and the different Tier1s
[1] https://twiki.cern.ch/twiki/bin/view/LHCOPN/OverallNetworkMaps
[2] MONIT link: https://monit-grafana-open.cern.ch/d/000000523/home?orgId=16&viewPanel=1

T0	Tier1s																		
CERN-PROD source (Write rates)	TW-ASGC	RRC-KI	ES-PIC	DE-KIT	FR-CCIN2P3	IT-INFN-CNAF	UK-RAL	NDGF (CH-LHEP)	NDGF (Scandinavia)	NL-T1(Nikhef, SA	PL-NCBJ	CN-IHEP	RRC-JINR	CA-TRIUMF	US-BNL	US-FNAL	RC-KISTI	Sum total	Sum total GB/s
ALICE				5	4	7	1		3	1	0	0	0	0	0	0	2	23	2.875
ATLAS (injected + prod))	0.1	0.8	13	38.4	43.5	27.7	43.5	0	24.4	18.9	0	0	0	28.6	67.4	0	0	306.3	38.2875
CMS	0	0	19	45	45	57	35	0	0	0	0	0	68	0	0	177		446	55.75
LHCb	0	0	4.38	23.54	13.14	17.61	34.02	0	0	9.88	8.76	8.93	0	0	0	0		120.26	15.0325
Total	0.1	0.8	36.38	111.94	105.64	109.31	113.52	0	27.4	29.78	8.76	8.93	68	28.6	67.4	177	2	895.56	111.945
Network Capacity[1]	10Gbps	100Gbps	100Gbps	200Gbps	100Gbps	200Gbps	200Gbps	100Gbps	100Gbps	400Gbps	20Gbps	20Gbps	100Gbps	100Gbps	200Gbps	200Gbps	40Gbps		
DUNE																			
Belle II (from KEK via LHCONE)	0	0	0	1.9	2.8	3.7	0	0	0	0	0	0	0	0	5.6	0	0	14	1.75

CERN-PROD destination (Read rates)	TW-ASGC	RRC-KI	ES-PIC	DE-KIT	FR-CCIN2P3	IT-INFN-CNAF	UK-RAL	NDGF (CH-LHEP)	NDGF (Scandinavia)	NL-T1(Nikhef, SA	PL-NCBJ	CN-IHEP	RRC-JINR	CA-TRIUMF	US-BNL	US-FNAL	RC-KISTI	Sum total	Sum total GB/s
ALICE				n/a	n/a	n/a	n/a		n/a	n/a							n/a	0	0
ATLAS (injected + prod))	0	0.08	1.64	6.36	6.57	4.19	6.16	0	3.27	3.42	0	0	0	5.94	10.86	0	0	48.49	6.06125
CMS	0	0	15	36	36	45	28	0	0	0	0	0	41	0	0	254		455	56.875
LHCb	0	0	3.44	14.26	10.31	13.74	20.62	0	0	6.87	7.65	5.41	0	0	0	0	0	82.3	10.2875
Total	0	0.08	20.08	56.62	52.88	62.93	54.78	0	3.27	10.29	7.65	5.41	41	5.94	10.86	254	0	585.79	73.22375
Network Capacity[1]	10Gbps	100Gbps	100Gbps	200Gbps	100Gbps	200Gbps	200Gbps	100Gbps	100Gbps	400Gbps	20Gbps	20Gbps	100Gbps	100Gbps	200Gbps	200Gbps	40Gbps		
DUNE			1				1			1					3.5	3.5			
Belle II																			

DC24 Planning per experiment | Tier0-Tier1s (Minimal rates) | **Tier-0-Tier1s (Higher rates)** | Tier1s to Tier1s rates | Transatlantic links | Tier2s expectations

Identified FR-CCIN2P3 to pass the link capacity.
They plan to update to 200Gbps link for DC24

Tier1s – Tier1s rates (High rates)

Routing Policies: https://twiki.cern.ch/twiki/bin/view/LHCOPN/RoutingPolicies						UNITS: Gbps				CERN Network capacity (full-duplex)	2.1 Tbps										
TOTAL																					
Source/Destination	TW-ASGC	RRC-KI	ES-PIC	DE-KIT	FR-CCIN2P3	IT-INFN-CNAF	UK-RAL	NDGF (CH-LHEP)	NDGF (Scandinavia)	NL-T1(Nikhef, SA	PL-NCBJ	CN-IHEP	RRC-JINR	CA-TRIUMF	US-BNL	US-FNAL	RC-KISTI	∑ [all T1s -> T1]	Exclude LHCONE		
TW-ASGC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
RRC-KI	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.5	0.5		
ES-PIC	0.0	0.0	0.1	1.9	1.8	1.6	1.4	0.0	1.9	1.1	0.0	0.0	0.7	0.7	1.1	2.0	0.0	14.3	12.7		
DE-KIT	0.0	0.1	1.7	1.2	5.3	4.0	5.5	0.0	5.6	2.6	0.0	0.0	1.4	2.5	5.2	4.4	0.0	39.5	34.2		
FR-CCIN2P3	0.0	0.1	1.8	5.3	0.8	3.3	5.3	0.0	6.4	4.4	0.0	0.0	1.3	3.1	5.6	4.1	0.0	41.5	32.8		
IT-INFN-CNAF	0.0	0.1	1.2	4.1	4.2	0.4	3.5	0.0	5.3	2.3	0.0	0.0	1.7	1.6	2.7	5.2	0.0	32.3	24.1		
UK-RAL	0.0	0.2	1.7	5.4	5.7	3.2	7.2	0.0	6.6	2.3	0.0	0.0	1.2	2.6	4.7	3.6	0.0	44.4	44.4		
NDGF (CH-LHEP)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
NDGF (Scandinavia)	0.0	0.2	0.4	1.3	1.4	0.9	1.9	0.0	0.5	0.9	0.0	0.0	0.0	0.8	1.8	0.0	0.0	10.1	10.1		
NL-T1(Nikhef, SARA)	0.0	0.0	0.4	1.6	2.4	0.9	1.3	0.0	2.9	0.6	0.0	0.0	0.0	1.1	2.0	0.0	0.0	13.2	13.2		
PL-NCBJ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
CN-IHEP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
RRC-JINR	0.0	0.0	0.7	1.5	1.4	1.7	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	12.1	12.1		
CA-TRIUMF	0.0	0.1	0.6	3.7	3.2	2.3	2.4	0.0	4.4	2.2	0.0	0.0	0.0	0.5	3.1	0.0	0.0	22.5	19.4		
US-BNL	0.0	0.2	1.6	12.9	6.4	4.6	6.3	0.0	9.1	6.7	0.0	0.0	0.0	3.9	2.0	0.0	0.0	53.6	49.7		
US-FNAL	0.0	0.0	3.1	6.5	6.1	7.6	5.5	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0	0.0	0.0	36.9	36.9		
RC-KISTI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
∑ [T1 -> all T1s]	0.0	0.9		45.3	38.7	30.7	41.6	0.0	42.7	23.1	0.0	0.0	14.4	16.8	28.4	24.8	0.0	307.3	290.0		

After summing up ATLAS, CMS and ALICE average we have this total matrix!

290Gbps (T1s non LHCONE)+ 895.56Gbps (T0 exports Heavy rates)
= 1185.56Gbps planned to pass via CERN network + PROD

CERN Network capacity full duplex is 2.1 Tbps

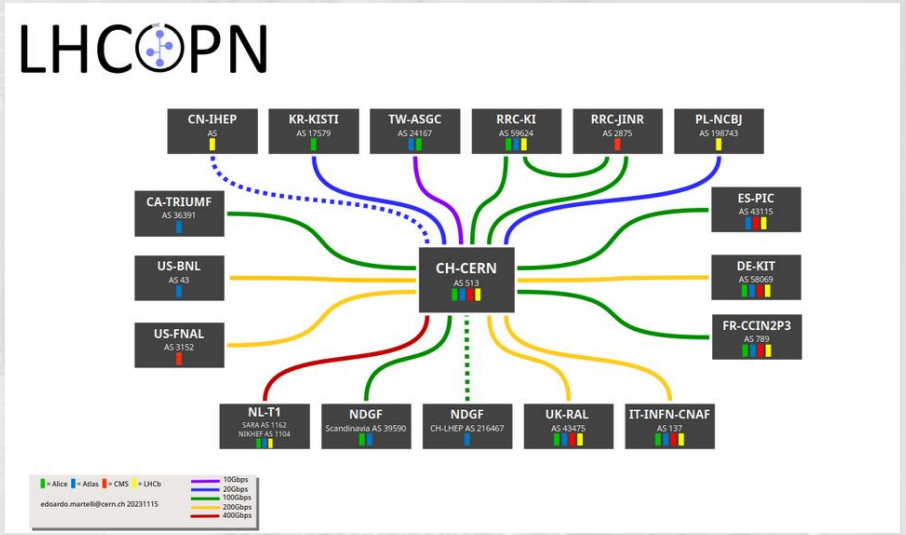
Network capacity for T1s full Matrix (High rates)

Routing Matrix

Preferred primary path: **OPN** for LHCOPN connectivity; **1** for LHCONE connectivity; **No** for connectivity outside LHCOPNE/ONE

From \\ To	CA-T	CH-C	DE-K	ES-P	FR-I	IT-C	KR-K	NDGF	NLT1	RRCK	RRCJ	TW-A	UK-R	US-F	US-B
CA-TRIUMF		OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	n/a	1
CH-CERN	OPN		OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN
DE-KIT	OPN	OPN		OPN	1	1	OPN	OPN	OPN	OPN	OPN	OPN	OPN	1	OPN
ES-PIC	OPN	OPN	OPN		OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN
FR-CCIN2P3	OPN	OPN	1	OPN		1	OPN	OPN	OPN	OPN	OPN	OPN	OPN	1	OPN
IT-INFN-CNAF	OPN	OPN	1	OPN	1		OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN
KR-KISTI	No	OPN	1	1	1	1		1	1	OPN	No	1	No	1	1
NDGF	OPN	OPN	OPN	OPN	OPN	OPN	OPN		OPN	OPN	OPN	OPN	OPN	OPN	OPN
NL-T1	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN		OPN	OPN	OPN	OPN	OPN	OPN
RRC-KI-T1		OPN													
RRC-JINR-T1		OPN													
TW-ASGC	OPN	OPN	OPN	OPN	OPN	OPN	1	OPN	OPN	OPN	OPN		OPN	1	1
UK-T1-RAL	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN	OPN		OPN	OPN
US-FNAL-CMS	OPN	OPN	1	OPN	1	OPN	OPN	OPN	OPN	OPN	OPN	1	OPN		1
US-T1-BNL	1	OPN	OPN	OPN	OPN	OPN	1	OPN	OPN	OPN	1	1	OPN	1	

https://twiki.cern.ch/twiki/bin/view/LHCOPN/RoutingPolicies



https://twiki.cern.ch/twiki/bin/view/LHCOPN/OverallNetworkMaps

Combination of sources to obtain the network links capacities.
This is important since traffic not going through LHCONE will pass via CERN network.

Network capacity for T1s full Matrix (High rates)

Network Capabilities	https://twiki.cern.ch/twiki/bin/view/LHCOPN/RoutingPolicies						Take into account that the communication in between Tier1s is passing throught CERN if not LHCONE! This is the maximum capacity in between the links (we are taking the slowest link capacity)										
Source/Destination	TW-ASGC	RRC-KI	ES-PIC	DE-KIT	FR-CCIN2P3	IT-INFN-CNAF	UK-RAL	NDGF (CH-LHEP)	NDGF (Scandinavia)	NL-T1(Nikhef, SA	PL-NCBJ	CN-IHEP	RRC-JINR	CA-TRIUMF	US-BNL	US-FNAL	RC-KISTI
TW-ASGC		10	10	10	10	10	10	10	10	10	10	10	10	10	LHCONE	LHCONE	LHCONE
RRC-KI	10		100	100	100	100	100	100	100	100	20	20	100	100	100	100	20
ES-PIC	10	100		100	100	100	100	100	100	100	20	20	100	100	100	100	LHCONE
DE-KIT	10	100	100		LHCONE	LHCONE	200	100	100	200	20	20	100	100	200	LHCONE	LHCONE
FR-CCIN2P3	10	100	100	LHCONE		LHCONE	100	100	100	100	20	20	100	100	100	LHCONE	LHCONE
IT-INFN-CNAF	10	100	100	LHCONE	LHCONE		200	100	100	200	20	20	100	100	200	200	LHCONE
UK-RAL	10	100	100	200	100	200		100	100	200	20	20	100	100	200	200	LHCONE
NDGF (CH-LHEP)	10	100	100	100	100	100	100		100	100	20	20	100	100	100	100	LHCONE
NDGF (Scandinavia)	10	100	100	100	100	100	100	100		100	20	20	100	100	100	100	LHCONE
NL-T1(Nikhef, SARA)	10	100	100	200	100	200	200	100	100		20	20	100	100	200	200	LHCONE
PL-NCBJ	10	20	20	20	20	20	20	20	20	20		20	20	20	20	20	LHCONE
CN-IHEP	10	20	20	20	20	20	20	20	20	20	20		20	20	20	20	LHCONE
RRC-JINR	10	100	100	100	100	100	100	100	100	100	20	20		20	100	20	LHCONE
CA-TRIUMF	10	100	100	100	100	100	100	100	100	100	20	20	100		LHCONE	LHCONE	LHCONE
US-BNL	LHCONE	100	100	200	100	200	200	100	100	100	20	20	LHONE	LHCONE		LHCONE	LHCONE
US-FNAL	LHCONE	100	100	LHCONE	LHCONE	200	200	100	100	100	20	20	100	100	LHCONE		LHCONE
RC-KISTI	LHCONE	20	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	LHCONE	

Voila! Thanks to Edoardo for the final review!

Transatlantic links (request by ATLAS)

	Network capacity		
Current Esnet links (3x100Gbps and 1x400Gbps)	700Gbps		
Expected before DC24 (3x100Gbps and 3x400Gbps)[1]	1500Gbps		
[1] https://indico.cern.ch/event/1280363/contributions/5602789/attachments/2736898/4759659/LHCONE%2051%20Meeting%20-%20ESnet%20Update%202023-10-18.pdf			
	Transalanitc Traffic from/to Tier1s and Tier2s		
	Europe → US + CA [Gbps]	US + CA → Europe [Gbps]	
ATLAS Transatlantic traffic	265	270	
CMS Transatlantic traffic			
Total	265		

DC24 Planning per experiment | Tier0-Tier1s (Minimal rates) | Tier-0-Tier1s (Higher rates) | Tier1s to Tier1s rates | **Transatlantic links** | Tier2s expectations

Workbook Statistics

Tier2 ingress/egress (ATLAS, CMS and DUNE)

T2 - network capabilities: https://wlcg-cric.cern.ch/core/netsite/list/ (not yet all numbers IN)
9 shared T2s between ATLAS and CMS (interesting the naming conversion effort ☺)
We need DUNE input to get the full combination

T2 Table: DC24	ATLAS		CMS		DUNE		Total		Capacity declared CRIC
Site	∑ ingress	∑ egress	∑ ingress	∑ egress	∑ ingress	∑ egress	∑ ingress	∑ egress	
CA-VICTORIA-WESTGRID-T2	3.2	1.4	0	0	0	0	3.2	1.4	100
Australia-ATLAS	0	0.3	0	0	0	0	0	0.3	10
CA-WATERLOO-T2	1	1	0	0	0	0	1	1	40
CA-SFU-T2	3.6	5.4	0	0	0	0	3.6	5.4	100
praguelcg2	18.7	16.2	0	0	0	0	18.7	16.2	100
MPPMU	1.8	1.4	0	0	0	0	1.8	1.4	none
wuppertalprod	2.8	1.9	0	0	0	0	2.8	1.9	none
DESY-ZN	15.4	13.2	0	0	0	0	15.4	13.2	40
DESY-HH/T2_DE_DESY	16.3	13.4	27.3	7.4	0	0	43.6	20.8	80
UNI-FREIBURG	1.9	1.8	0	0	0	0	1.9	1.8	none
CYFRONET-LCG2/T2_PL_Cyfronet	2.9	1.4	1.8	0.5	0	0	4.7	1.9	10
GoeGrid	3.1	1.4	0	0	0	0	3.1	1.4	none
IEPSAS-Kosice	0.7	0.4	0	0	0	0	0.7	0.4	none
LRZ-LMU	1.6	1.8	0	0	0	0	1.6	1.8	none
CSCS-LCG2/T2_CH_CSCS	25	22.4	18.5	3.2	0	0	43.5	25.6	none

DC24 Planning per experiment | Tier0-Tier1s (Minimal rates) | Tier-0-Tier1s (Higher rates) | Tier1s to Tier1s rates | Transatlantic links | **Tier2s ingress-egress** | +

What else we need to know/combine?

- Average file size
- HTTP for the vast majority of transfers
  - plus XRootD for AAA in the case of CMS
  - ALICE is XRootD only
- T2s' verification of network capacity

Rates for DC 2024

Combined numbers:
Experiments/Network/CRIC

Up to date and same language
(site names + units)

One collaborative document
Editors: link
Viewer: link

Thanks to Experiments, Network team and CRIC team