Excel Template For IoT Modeling

Este excel é um Template para criar Modelos de IoT Dimensioning.
Funciona através da macro 'CreateTablesFromInput' que usa instruções de inputs, definidas na folha 'Model Configurator'*, e cria tabelas.

*(se o nome desta folha for alterado a macro não irá funcionar. Caso se queira alterar o seu nome é preciso alterar código também)

Cover | User Guide | Configurator >> | Model Configurator | Inputs 1 >> | Study Years | Regions | Verticals_Sectors | Network Parameters | Base Stations Sites | Inputs 2 >> | Base Stations Profiles | Throughput Formulas | Base Statior

Ready | Accessibility: Investigate | 100%

Input | Model Configurator

This sheet allows building multiple tables with some inputs.

MODEL CONFIGURATOR

Name	Type of Instruction	Sheet	First Cell	Row Shift/Distance	Column Shift/Distance	Width of Inputs	Maximum length of	Title is first Column	Create Sheets for each year	Copy Output Header for each	Only Copy Format	Clear Data	Fixed References	Last Input is Total	Count in Total
Verticals	Column	Verticals_Sectors	B8												
Througput Formulas	Output	Throughput Formulas	B11									Keep			
Sites	Column	Base Stations Sites	B13												
Sites per Region	Output	Sites per Region	B9									Keep			
Sites	Title	Base Stations Sites	B13					X							
Parameters	Header	Base Stations Sites	E10												
Site Data	Column	Base Stations Sites	D11												
Formats	Column	Base Stations Sites	E11		1						X				
Auto Option	Column	Base Stations Sites	F11		2										
Base Stations Profiles	Output	Base Stations Profiles	B8	2								Keep			
Sites	Column	Base Stations Sites	B13												
Base Stations Parameters	Output	Base Stations Parameters	B11									Keep			
Years	Years	Study Years	B8		1										
Regions	Title	Regions	B8		1										
Headers	Header	Throughput Formulas	B8	1		3									
Verticals	Column	Verticals_Sectors	B8												
Formats	Column	Throughput Formulas	D11		2	9	17				X				
Formulas	Column	Throughput Formulas	M11		11	4	17								
Totals	Header	Throughput Formulas	B28			2									
Troughput	Output	Troughput	B8	3	2					X		Keep			
Years	Years	Study Years	B8		1		1								
Regions	Title	Regions	B8	3	1		1								
Sites	Column	Base Stations Sites	B13												
Output Formulas	Output	Output Formulas	B8									Keep			
Years	Years	Study Years	B8		1										
Regions	Title	Regions	B8		1										
Results	Header	Output Formulas	B11	1		2									
Sites	Column	Base Stations Sites	B13												
Formulas	Column	Output Formulas	D13		2	11									
Output	Output	Model Output	B8	1	2							Clear			

Cover | User Guide | Configurator >> | Model Configurator | Inputs 1 >> | Study Years | Regions | Verticals_Sectors | Network Parameters | Base Stations Sites | Inputs 2 >> | Base Stations Profiles | Throughput Formulas | Base Station

Ready | Accessibility: Investigate | 100%

Input | Study Years

Study Years

STUDY YEARS

2023
2025
2030

Input | Regions

Regions

REGIONS

Central Coast
Cessnock
Dungog
Lake Macquarie
Maitland
Muswellbrook
Newcastle
Port Stephens
Singleton
UpperHunter

A1 | Input | Verticals/Sectors

Input | Verticals/Sectors

Verticals/Sectors

VERTICALS/SECTORS

Agriculture, forestry, fishing, and hunting, mining, quarrying, and oil and gas extraction
Utilities
Construction
Manufacturing
Wholesale trade & Retail trade
Transportation and warehousing
Finance and insurance & Real estate and rental and leasing services
Professional, scientific, and technical services
Management of companies and enterprises & Administrative and support services, waste management and remediation services
Educational services
Health care and social assistance
Arts, entertainment, and recreation & Information and cultural industries
Accommodation and food services
Other services (excluding public administration)
Public administration
Households & Consumer Goods
Visitor Demand

Input | Network Parameters

Network Parameters

NETWORK PARAMETERS

Peak Concurrent Devices Traffic (Busy Hours) [Mbps]	0.2
Busy Hour/Contention Ratio [Mbps]	60
+ Headroom Extra Capacity	20%

Input | Base Stations Sites

Base Stations Sites

BASE STATIONS SITES

Sites	Maximum Simultaneously Active Users per Site	Site Parameters: Data
	Maximum Throughput for Downlink per Site	. Manual
Standalone 5G Site - 3 Sectors - Auto		
Standalone 5G Site - 3 Sectors		
Standalone 5G Site - 2 Sectors - Auto		
Standalone 5G Site - 2 Sectors		
Standalone 5G Site - 1 Sector - Auto		
Standalone 5G Site - 1 Sector		
Standalone 4G Site - 3 Sectors - Auto		
Standalone 4G Site - 3 Sectors		
Standalone 4G Site - 2 Sectors - Auto		
Standalone 4G Site - 2 Sectors		
Standalone 4G Site - 1 Sector - Auto		
Standalone 4G Site - 1 Sector		
Total		

D10 | Auto

Input | Base Stations Profiles

Base Stations Profiles

BASE STATIONS PROFILES

Standalone 5G Site - 3 Sectors - Auto	Data	
Maximum Simultaneously Active Users per Site	2500	
Maximum Throughput for Downlink per Site	~~17000~~	Auto
		Manual
		Auto
Standalone 5G Site - 3 Sectors	Data	
Maximum Simultaneously Active Users per Site	2500	
Maximum Throughput for Downlink per Site	17000	Manual
Standalone 5G Site - 2 Sectors - Auto	Data	
Maximum Simultaneously Active Users per Site	1500	
Maximum Throughput for Downlink per Site	~~12000~~	Auto
Standalone 5G Site - 2 Sectors	Data	
Maximum Simultaneously Active Users per Site	1500	
Maximum Throughput for Downlink per Site	12000	Manual
Standalone 5G Site - 1 Sector - Auto	Data	
Maximum Simultaneously Active Users per Site	750	
Maximum Throughput for Downlink per Site	~~5000~~	Auto
Standalone 5G Site - 1 Sector	Data	
Maximum Simultaneously Active Users per Site	750	
Maximum Throughput for Downlink per Site	5000	Manual

Maximum Throughput for Downlink per Site	5000	Manual	
Standalone 4G Site - 3 Sectors - Auto	Data		
Maximum Simultaneously Active Users per Site	1500		
Maximum Throughput for Downlink per Site	~~2000~~	Auto	
Standalone 4G Site - 3 Sectors	Data		
Maximum Simultaneously Active Users per Site	1500		
Maximum Throughput for Downlink per Site	2000	Manual	
Standalone 4G Site - 2 Sectors - Auto	Data		
Maximum Simultaneously Active Users per Site	800		
Maximum Throughput for Downlink per Site	~~1200~~	Auto	
Standalone 4G Site - 2 Sectors	Data		
Maximum Simultaneously Active Users per Site	800		
Maximum Throughput for Downlink per Site	1200	Manual	
Standalone 4G Site - 1 Sector - Auto	Data		
Maximum Simultaneously Active Users per Site	400		
Maximum Throughput for Downlink per Site	~~300~~	Auto	
Standalone 4G Site - 1 Sector	Data		
Maximum Simultaneously Active Users per Site	400		
Maximum Throughput for Downlink per Site	300	Manual	

Input | Troughput Formulas

Troughput Formulas

TROUGHPUT FORMULAS

Verticals/ Sectors	Devices	Throughput [Mbps]								Average Throughput per Device [Mbps]	Peak Concurrent Devices Traffic (Busy Hours) [Mbps]	Busy Hour/Contention Ratio [Mbps]	+ Headroom Extra Capacity
		0.5	1	2	5	10	50	100	1000		0.2	60	20%
Agriculture, forestry, fishing, and hunting, mining, quarrying, and oil and gas extraction										=SUMPRODUCT($E$9:$L$9;E11:L11)	=(SUMPRODUCT($E$9:$L$9;E11:L11))*$N$9*D11	=N11/$O$9	=O11*(1+$P$9)
Utilities										0.0	0	0	0
Construction										0.0	0	0	0
Manufacturing										0.0	0	0	0
Wholesale trade & Retail trade										0.0	0	0	0
Transportation and warehousing										0.0	0	0	0
Finance and insurance & Real estate and rental and leasing services										0.0	0	0	0
Professional, scientific, and technical services										0.0	0	0	0
Management of companies and enterprises & Administrative and support services, waste management and remediation services										0.0	0	0	0
Educational services										0.0	0	0	0
Health care and social assistance										0.0	0	0	0
Arts, entertainment, and recreation & Information and cultural industries										0.0	0	0	0
Accommodation and food services										0.0	0	0	0
Other services (excluding public administration)										0.0	0	0	0
Public administration										0.0	0	0	0
Households & Consumer Goods										0.0	0	0	0
Visitor Demand										0.0	0	0	0
Total	=SUM(D11:D27)										=SUM(N11:N27)	=N28/$O$9	=O28*(1+$P$9)
											=N28/D28	=N29/$O$9	=O29*(1+$P$9)

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Input | Base Stations Parameters

Base Stations Parameters

BASE STATIONS PARAMETERS

Sites	Cost per site	Calculated Throughput (Mbps)	Throughput Calculation					SNR Calculation				
			Bandwidth (MHz)	Sectors	MIMO Layers	Overhead η	SNR	Signal Power (dBm)	Noise Power (dBm)	Interference margin (dB)	Transmit power (dBm)	Ant
Standalone 5G Site - 3 Sectors - Auto	175 000 €	=G10*F10*H10*LOG(1+J10;2)*$I10	100	3	8	0.75	=10^((K10-L10-$M10)/10)	=N10+O10-P10-Q10	-87	8	43	
Standalone 5G Site - 3 Sectors	175 000 €	1578.86	100	3	8	0.75	0.84	-79.77	-87	8	43	
Standalone 5G Site - 2 Sectors - Auto	145 000 €	1052.57	100	2	8	0.75	0.84	-79.77	-87	8	43	
Standalone 5G Site - 2 Sectors	145 000 €	1052.57	100	2	8	0.75	0.84	-79.77	-87	8	43	
Standalone 5G Site - 1 Sector - Auto	100 000 €	526.29	100	1	8	0.75	0.84	-79.77	-87	8	43	
Standalone 5G Site - 1 Sector	100 000 €	526.29	100	1	8	0.75	0.84	-79.77	-87	8	43	
Standalone 4G Site - 3 Sectors - Auto	95 000 €	254.56	20	3	4	0.75	1.67	-83.79	-94	8	40	
Standalone 4G Site - 3 Sectors	95 000 €	254.56	20	3	4	0.75	1.67	-83.79	-94	8	40	
Standalone 4G Site - 2 Sectors - Auto	80 000 €	169.71	20	2	4	0.75	1.67	-83.79	-94	8	40	
Standalone 4G Site - 2 Sectors	80 000 €	169.71	20	2	4	0.75	1.67	-83.79	-94	8	40	
Standalone 4G Site - 1 Sector - Auto	60 000 €	84.85	20	1	4	0.75	1.67	-83.79	-94	8	40	
Standalone 4G Site - 1 Sector	60 000 €	84.85	20	1	4	0.75	1.67	-83.79	-94	8	40	

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SNR Calculation			Signal Power Calculation				Path Loss Calculation		
Signal Power (dBm)	Noise Power (dBm)	Interference margin (dB)	Transmit power (dBm)	Antenna Gains (dBi)	Path Loss (dB)	Other Losses (dB)	Carrier frequency (GHz)	Base station height (m)	Distance between antenas (m)
=N10+O10-P10-Q10	-87	8	43	24	=MAX(13.54+39.08*LOG10(T10)+20*LOG10(R10)-0.6*(S10-1.5);28+22*LOG10(T10)+20*LOG10(R10))	23	3.5	25	800
-79.77	-87	8	43	24	123.77	23	3.5	25	800
-79.77	-87	8	43	24	123.77	23	3.5	25	800
-79.77	-87	8	43	24	123.77	23	3.5	25	800
-79.77	-87	8	43	24	123.77	23	3.5	25	800
-79.77	-87	8	43	24	123.77	23	3.5	25	800
-83.79	-94	8	40	18	118.79	23	1.8	30	1000
-83.79	-94	8	40	18	118.79	23	1.8	30	1000
-83.79	-94	8	40	18	118.79	23	1.8	30	1000
-83.79	-94	8	40	18	118.79	23	1.8	30	1000
-83.79	-94	8	40	18	118.79	23	1.8	30	1000
-83.79	-94	8	40	18	118.79	23	1.8	30	1000

Input | Sites per Region

Sites per Region

#NUM!

SITES PER REGION

Sites	Central Coast	Cessnock	Dungog	Lake Macquarie	Maitland	Muswellbrook	Newcastle	Port Stephens	Singleton	UpperHunter
Standalone 5G Site - 3 Sectors - Auto	317	43	12	163	104	19	162	27	32	40
Standalone 5G Site - 3 Sectors	317	43	12	163	104	19	162	27	32	40
Standalone 5G Site - 2 Sectors - Auto	316	44	15	91	82	30	154	45	26	26
Standalone 5G Site - 2 Sectors	316	44	15	91	82	30	154	45	26	26
Standalone 5G Site - 1 Sector - Auto	351	31	12	68	76	29	66	39	33	35
Standalone 5G Site - 1 Sector	351	31	12	68	76	29	66	39	33	35
Standalone 4G Site - 3 Sectors - Auto	341	45	9	196	114	32	109	38	43	36
Standalone 4G Site - 3 Sectors	341	45	9	196	114	32	109	38	43	36
Standalone 4G Site - 2 Sectors - Auto	311	30	5	186	92	31	154	33	27	35
Standalone 4G Site - 2 Sectors	311	30	5	186	92	31	154	33	27	35
Standalone 4G Site - 1 Sector - Auto	328	48	10	99	103	20	128	39	44	40
Standalone 4G Site - 1 Sector	328	48	10	99	103	20	128	39	44	40

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Input | Troughput

Troughput

TROUGHPUT

2023
Central Coast

Verticals/ Sectors	Devices	Throughput [Mbps]								Average Throughput per Device [Mbps]	Peak Concurrent Devices Traffic (Busy Hours) [Mbps]	Busy Hour/Contention Ratio [Mbps]	+ Headroom Extra Capacity
		0.5	1	2	5	10	50	100	1000		0.2	60	20%
Agriculture, forestry, fishing, and hunting, mining, quarrying, and oil and gas extraction	23 815	30%	30%	25%	5%	5%	2%	2%	1.0%	14.7	70 017	1 167	1 400
Utilities	18 319	30%	30%	20%	5%	10%	2%	2%	1.0%	15.1	55 325	922	1 106
Construction	210 673	5%	15%	15%	25%	22%	10%	5%	3.0%	43.9	1 850 764	30 846	37 015
Manufacturing	108 085	20%	25%	30%	15%	5%	2%	2%	1.0%	15.2	328 577	5 476	6 572
Wholesale trade & Retail trade	227 161	5%	15%	20%	24%	15%	15%	5%	1.0%	25.8	1 171 013	19 517	23 420
Transportation and warehousing	67 782	12%	10%	10%	20%	30%	10%	5%	3.0%	44.4	601 360	10 023	12 027
Finance and insurance & Real estate and rental and leasing services	89 765	5%	20%	30%	15%	14%	10%	5%	1.0%	23.0	412 471	6 875	8 249
Professional, scientific, and technical services	109 916	5%	10%	10%	15%	25%	16%	15%	4.0%	66.6	1 463 538	24 392	29 271
Management of companies and enterprises & Administrative and support services, waste management and remediation services	60 454	30%	25%	25%	10%	5%	2%	2%	1.0%	14.9	180 153	3 003	3 603
Educational services	150 219	10%	12%	12%	10%	18%	20%	15%	3.0%	57.7	1 733 829	28 897	34 677
Health care and social assistance	326 085	10%	15%	20%	18%	15%	10%	10%	2.0%	38.0	2 478 250	41 304	49 565
Arts, entertainment, and recreation & Information and cultural industries	54 958	25%	20%	17%	15%	10%	10%	2%	1.0%	19.4	213 403	3 557	4 268
Accommodation and food services	128 236	30%	27%	20%	5%	10%	5%	2%	1.0%	16.6	424 974	7 083	8 499
Other services (excluding public administration)	69 614	10%	14%	15%	20%	25%	10%	5%	1.0%	24.0	334 007	5 567	6 680
Public administration	111 748	10%	15%	20%	22%	20%	10%	2%	1.0%	20.7	462 638	7 711	9 253
Households & Consumer Goods	1 448 001	5%	5%	10%	10%	15%	20%	25%	10.0%	137.3	39 754 872	662 581	795 097
Visitor Demand	60 135	5%	13%	20%	25%	20%	10%	5%	2.0%	33.8	406 574	6 776	8 131
Total	3 264 968										51 941 763	865 696.06	1 038 835.27
											15.90881418	0.265146903	0.318176284

2025
Central Coast

Verticals/ Sectors	Devices	0.5
Agriculture, forestry, fishing, and hunting, mining, quarrying, and oil and gas extraction	32 046	3
Utilities	24 651	3
Construction	283 482	
Manufacturing	145 439	2
Wholesale trade & Retail trade	305 667	
Transportation and warehousing	91 207	1
Finance and insurance & Real estate and rental and leasing services	120 788	
Professional, scientific, and technical services	147 904	
Management of companies and enterprises & Administrative and support services, waste management and remediation services	81 347	3
Educational services	202 135	1
Health care and social assistance	438 781	1
Arts, entertainment, and recreation & Information and cultural industries	73 952	2
Accommodation and food services	172 554	3
Other services (excluding public administration)	93 672	1
Public administration	150 369	1
Households & Consumer Goods	1 492 613	
Visitor Demand	65 669	
Total	3 922 274	

2023
Cessnock

Verticals/ Sectors	Devices	Throughput [Mbps]								Average Throughput per Device [Mbps]	Peak Concurrent Devices Traffic (Busy Hours) [Mbps]	Busy Hour/Contention Ratio [Mbps]	+ Headroom Extra Capacity
		0.5	1	2	5	10	50	100	1000		0.2	60	20%
Agriculture, forestry, fishing, and hunting, mining, quarrying, and oil and gas extraction	34 536	30%	30%	25%	5%	5%	2%	2%	1.0%	14.7	101 535	1 692	2 031
Utilities	4 490	30%	30%	20%	5%	10%	2%	2%	1.0%	15.1	13 559	226	271
Construction	31 773	5%	15%	15%	25%	22%	10%	5%	3.0%	43.9	279 124	4 652	5 582
Manufacturing	25 902	20%	25%	30%	15%	5%	2%	2%	1.0%	15.2	78 741	1 312	1 575
Wholesale trade & Retail trade	41 788	5%	15%	20%	24%	15%	15%	5%	1.0%	25.8	215 418	3 590	4 308
Transportation and warehousing	14 160	12%	10%	10%	20%	30%	10%	5%	3.0%	44.4	125 624	2 094	2 512

2025
Cessnock

Verticals/ Sectors	Devices	0.5
Agriculture, forestry, fishing, and hunting, mining, quarrying, and oil and gas extraction	46 471	3
Utilities	6 041	3
Construction	42 753	
Manufacturing	34 853	2
Wholesale trade & Retail trade	56 230	
Transportation and warehousing	19 053	1

Inputs 1 >> | Study Years | Regions | Verticals_Sectors | Network Parameters | Base Stations Sites | Inputs 2 >> | Base Stations Profiles | Throughput Formulas | Base Stations Parameters | Sites per Region | Inputs 3 >> | Troughput

Ready | Accessibility: Investigate | 70%

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Input | Output Formulas

Output Formulas

OUTPUT FORMULAS

2023

Central Coast

Sites	Percentages	Total per Percentage		Units	Capacity Per Site
		Active Users	Throughput (Mbps)		Active Users

Standalone 5G Site - 3 Sectors - Auto	15.0%	=ROUNDDOWN(LET(
		data;INDIRECT("'Troughput'!$B:$ZZ");
		yearRow; INDEX(data;8;);
		colSite;INDEX(data;;1);
		colC;INDEX(data;;2);
		startCol;MATCH(C$8;yearRow;0);
		rowRegion;MATCH(C$9;colC;0);
		VLOOKUP("Total";DROP(data;rowRegion;startCol-2);3;0)
		)*D13;0)
			=LET(
			data; INDIRECT("'Troughput'!$B:$ZZ");
			yearRow; INDEX(data;8;);
			colSite; INDEX(data;;1);
			colC; INDEX(data;;2);
			colData; INDEX(data;;15);
			startCol;MATCH(C$8;yearRow;0);
			rowRegion; MATCH(C$9; colC; 0);
			VLOOKUP("Total";DROP(data;rowRegion;startCol-2);15;0)
			)*D13
				=INDEX('Sites per Region'!$A:$Z;
				MATCH(B13;'Sites per Region'!$B:$B;0);
				MATCH(C$9;'Sites per Region'!$8:$8; 0))
					=LET(
					data;'Base Stations Profiles'!$B:$E;
					colSite;INDEX(data;;1);
					colData;INDEX(data;;2);
					rowRegion;MATCH(B13;colSite;0);
					rowUser;MATCH("Maximum Simultaneously Active Users per Site";DROP(colSite;rowRegion);0);
					INDEX(colData;rowRegion+rowUser))
						=G
						0

Standalone 5G Site - 3 Sectors	15.0%	489 745	155 825.29	317	2 500	
Standalone 5G Site - 2 Sectors - Auto	15.0%	489 745	155 825.29	316	1 500	
Standalone 5G Site - 2 Sectors	15.0%	489 745	155 825.29	316	1 500	
Standalone 5G Site - 1 Sector - Auto	7.5%	244 872	77 912.64	351	750	
Standalone 5G Site - 1 Sector	7.5%	244 872	77 912.64	351	750	
Standalone 4G Site - 3 Sectors - Auto	5.0%	163 248	51 941.76	341	1 500	
Standalone 4G Site - 3 Sectors	5.0%	163 248	51 941.76	341	1 500	
Standalone 4G Site - 2 Sectors - Auto	5.0%	163 248	51 941.76	311	800	
Standalone 4G Site - 2 Sectors	5.0%	163 248	51 941.76	311	800	
Standalone 4G Site - 1 Sector - Auto	2.5%	81 624	25 970.88	328	400	
Standalone 4G Site - 1 Sector	2.5%	81 624	25 970.88	328	400	
Total	100.0%	2 775 219	883 009.98			

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Capacity Per Site		Saturation		Cost		
Active Users	Throughput (Mbps)	Active Users	Throughput (Mbps)	One Site Cost (€)	Sites to Cover	Cost to Cover (€)

=LET(
data;'Base Stations Profiles'!$B:$E;
colSite;INDEX(data;;1);
colData;INDEX(data;;2);
rowRegion;MATCH(B13;colSite;0);
rowUser;MATCH("Maximum Simultaneously Active Users per Site";DROP(colSite;rowRegion);0);
INDEX(colData;rowRegion+rowUser))
	=G10*F10*H10*LOG(1+J10;2)*$I10	=IF($G13<=0;0;E13/(H13*$G13)	=IF($G13<=0;0;F13/(I13*$G13))	=VLOOKUP(B13;'Base Stations Parameters'!$B:$D;3;0	=ROUNDUP(MAX(E13/H13-G13;F13/I13-G13;0);0)	=M13*L13

2 500	17 000.00	62%	3%	175 000 €	0	- €
1 500	1 052.57	103%	47%	145 000 €	11	1 595 000 €
1 500	12 000.00	103%	4%	145 000 €	11	1 595 000 €
750	526.29	93%	42%	100 000 €	0	- €
750	5 000.00	93%	4%	100 000 €	0	- €
1 500	254.56	32%	60%	95 000 €	0	- €
1 500	2 000.00	32%	8%	95 000 €	0	- €
800	169.71	66%	99%	80 000 €	0	- €
800	1 200.00	66%	14%	80 000 €	0	- €
400	84.85	62%	93%	60 000 €	0	- €
400	300.00	62%	26%	60 000 €	0	- €
					22	3 190 000 €

Verticals_Sectors | Network Parameters | Base Stations Sites | Inputs 2 >> | Base Stations Profiles | Throughput Formulas | Base Stations Parameters | Sites per Region | Inputs 3 >> | Troughput | Inputs 4 >> | Output Formulas | Outputs

Ready | Accessibility: Investigate | 90%