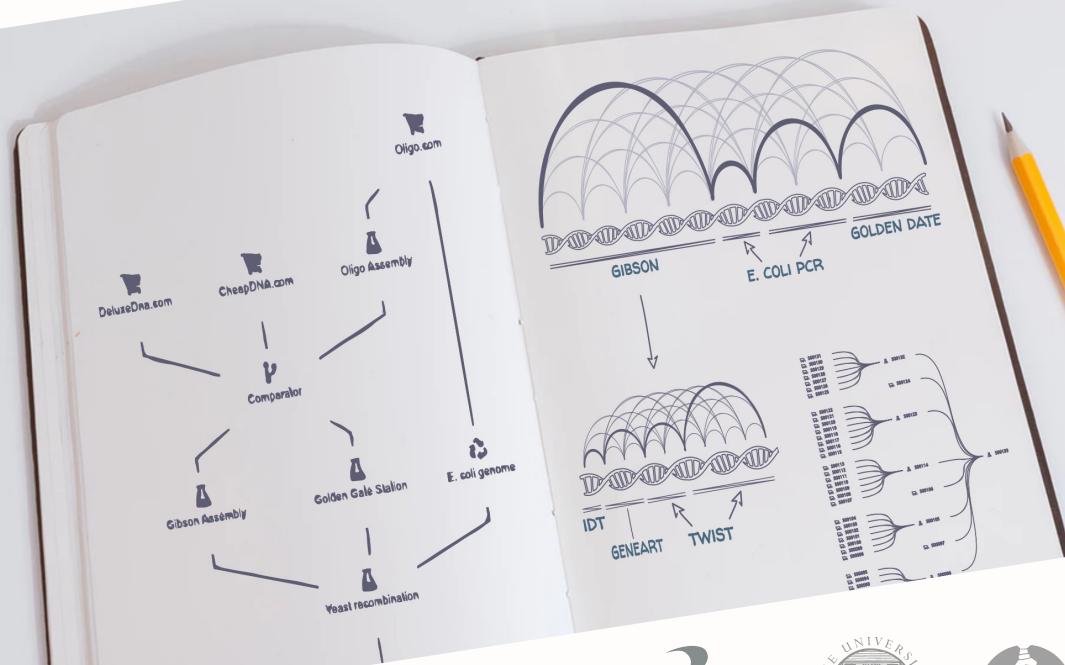
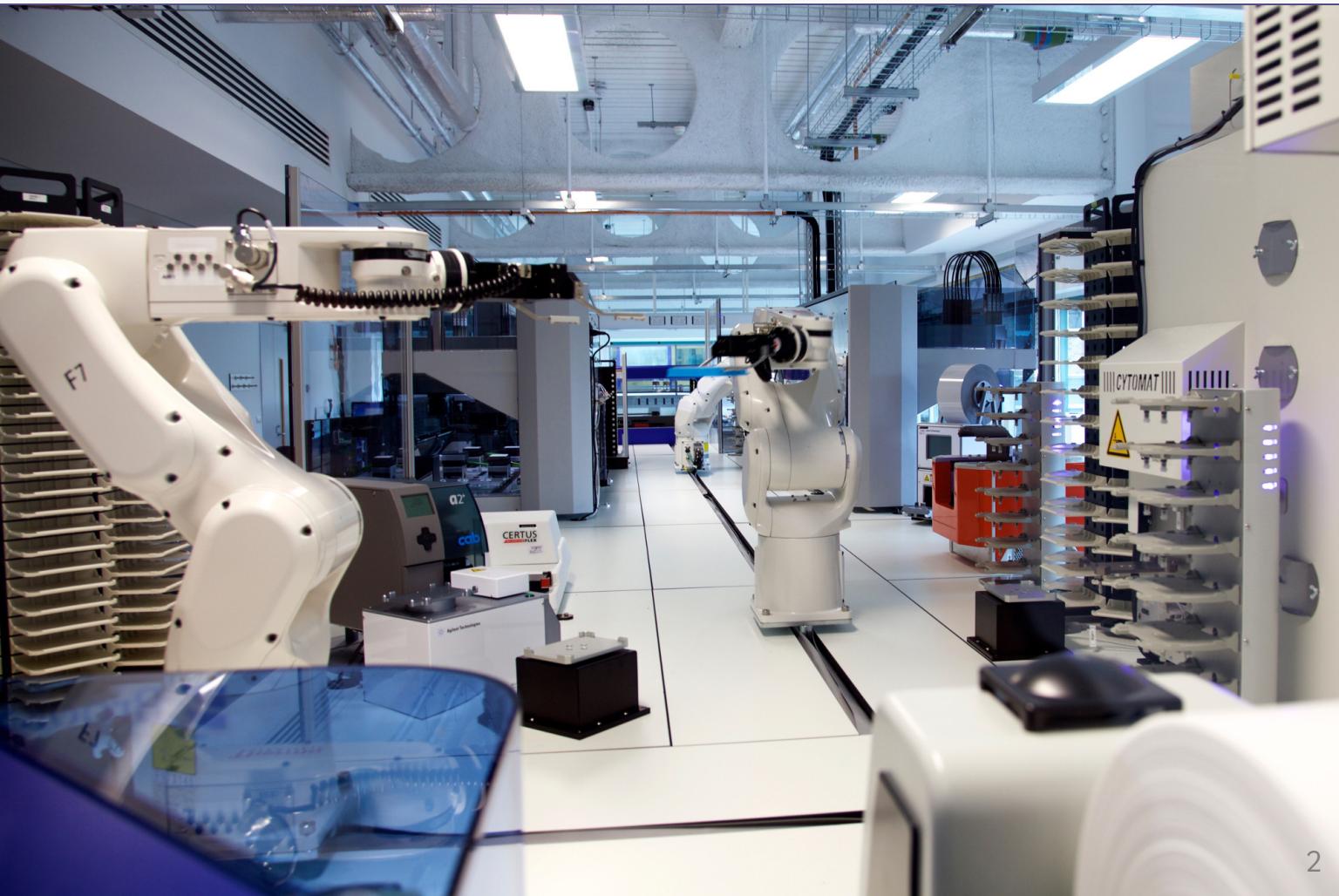


DNA Weaver - Optimal Assembly Strategies via Supply Networks and Shortest Path Algorithms

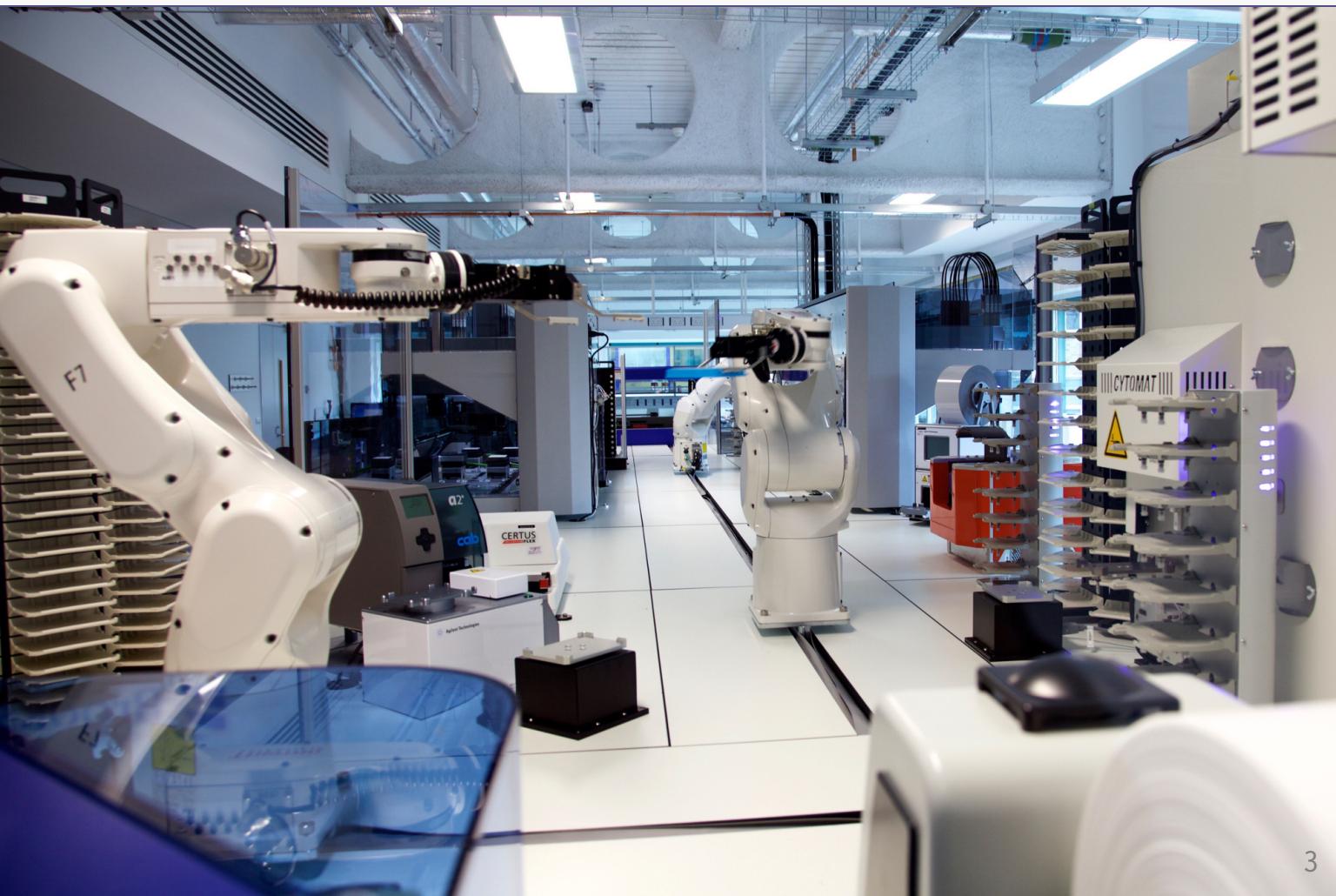
Valentin Zulkower, Susan Rosser, Edinburgh Genome Foundry



Introducing the Edinburgh Genome foundry (get in touch!)



Challenge: onboarding projects takes a lot of time!

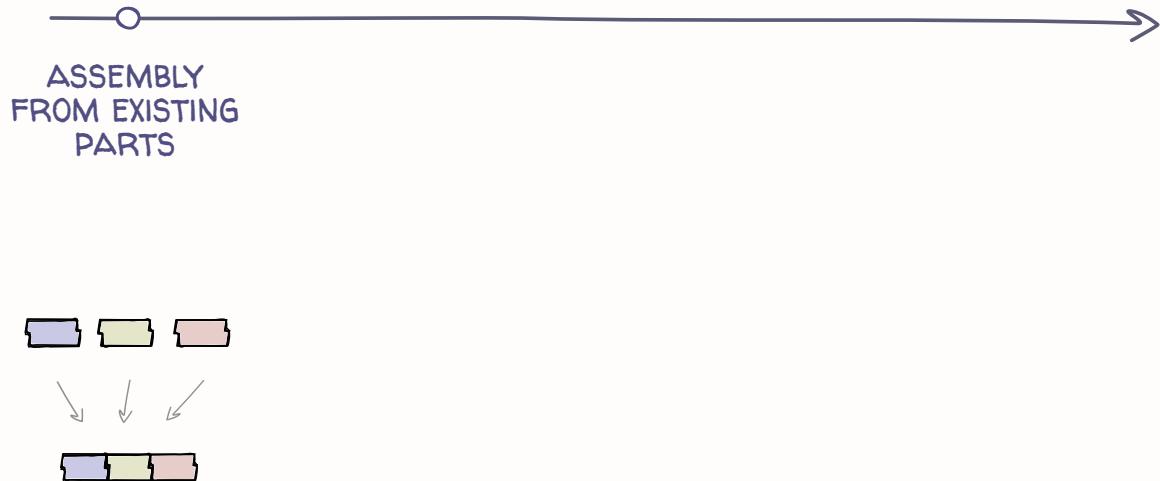


Problem: assembly projects are varied and complex

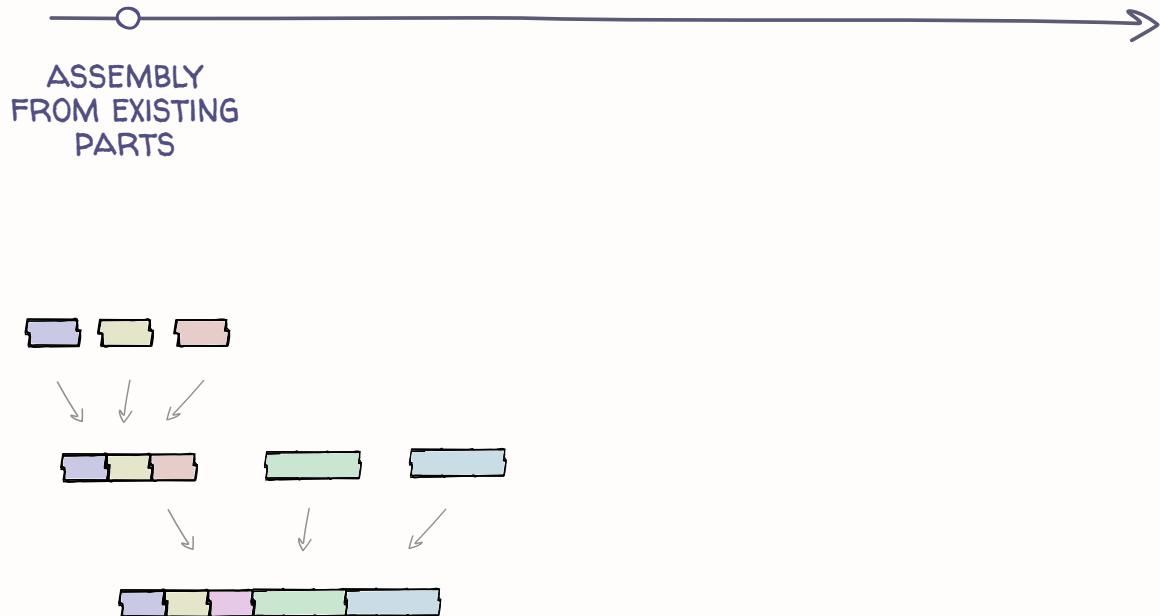
Problem: assembly projects are varied and complex



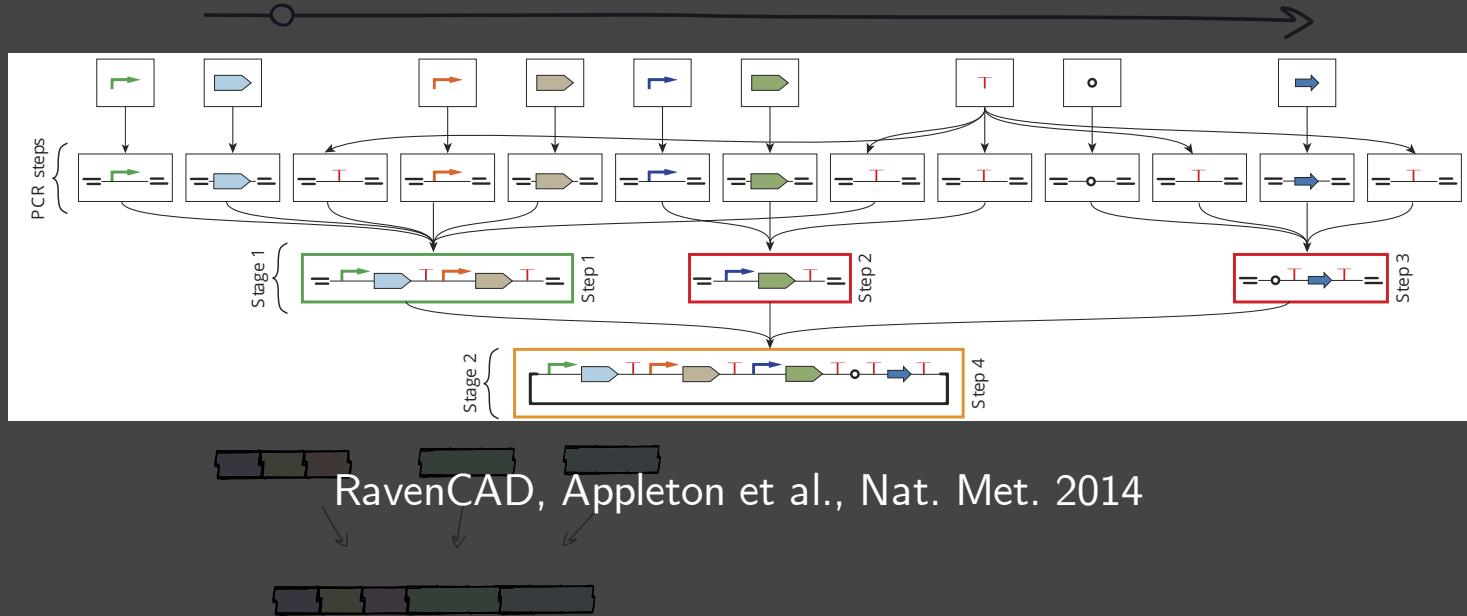
Problem: assembly projects are varied and complex



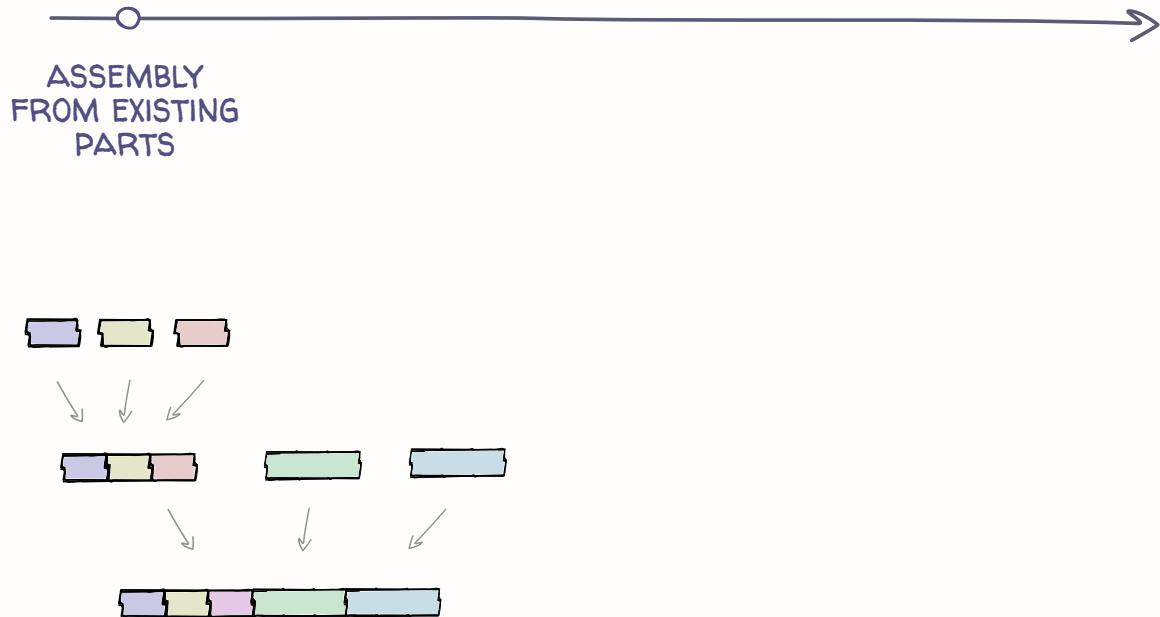
Problem: assembly projects are varied and complex



Problem: assembly projects are varied and complex



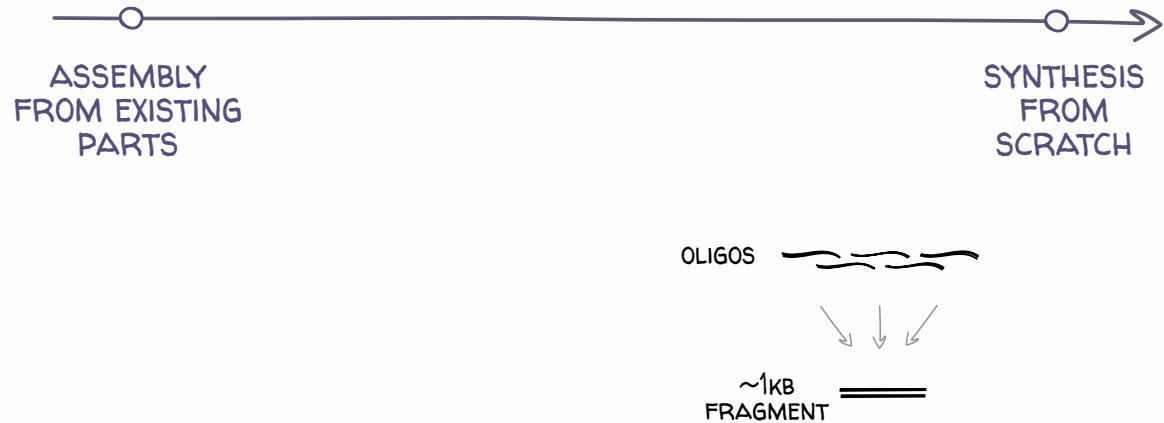
Problem: assembly projects are varied and complex



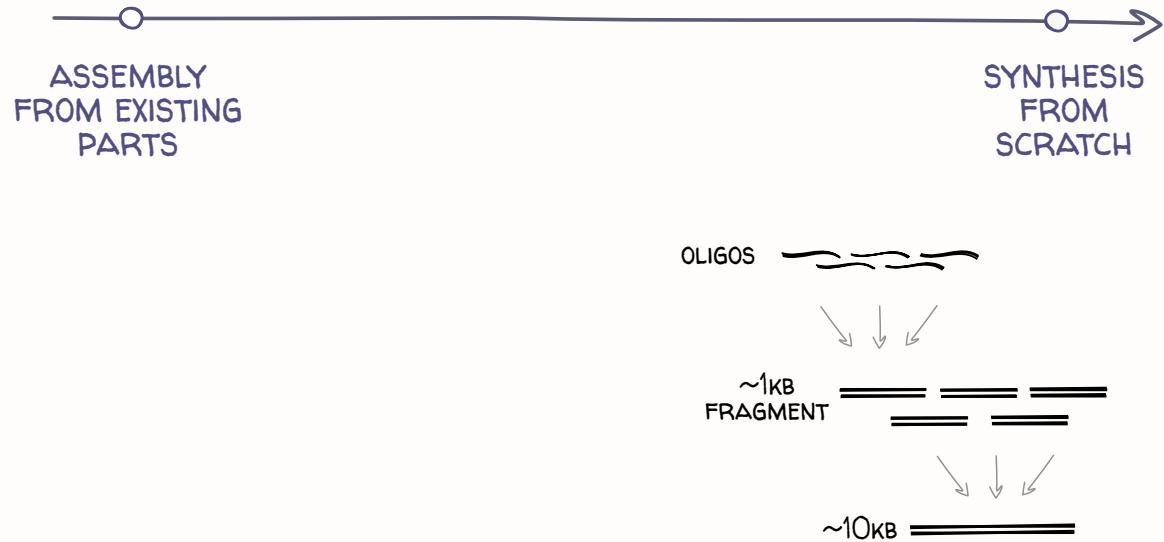
Problem: assembly projects are varied and complex



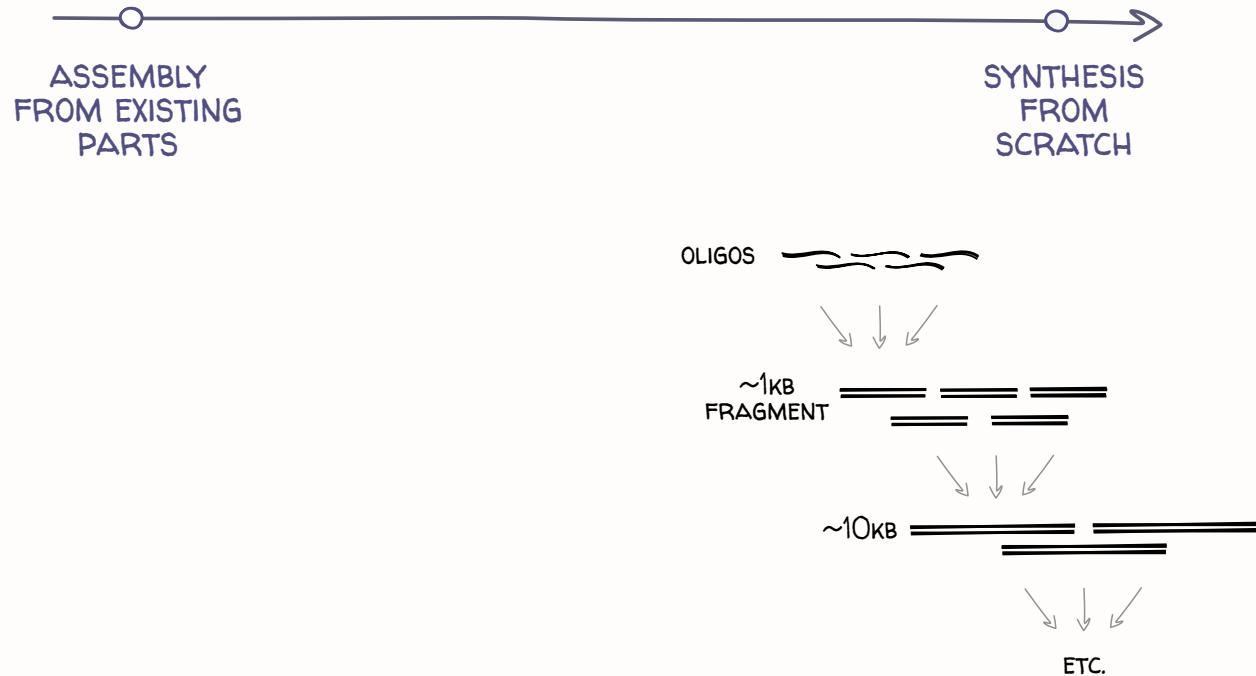
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Problem: assembly projects are varied and complex



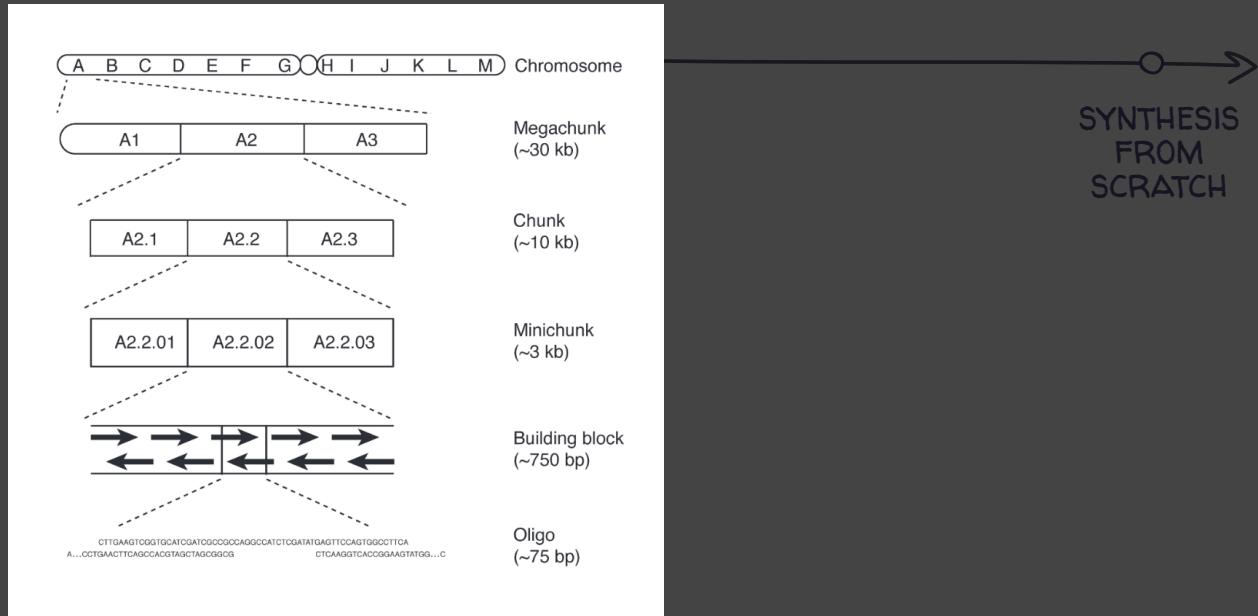
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Problem: assembly projects are varied and complex



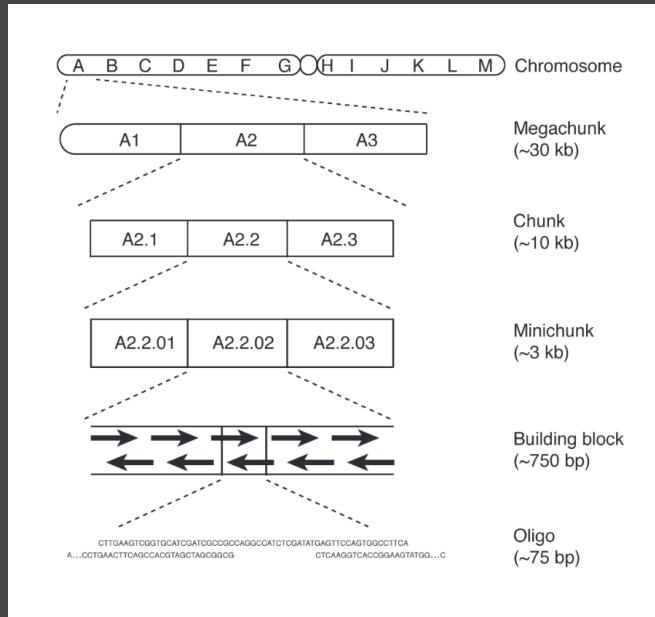
Problem: assembly projects are varied and complex



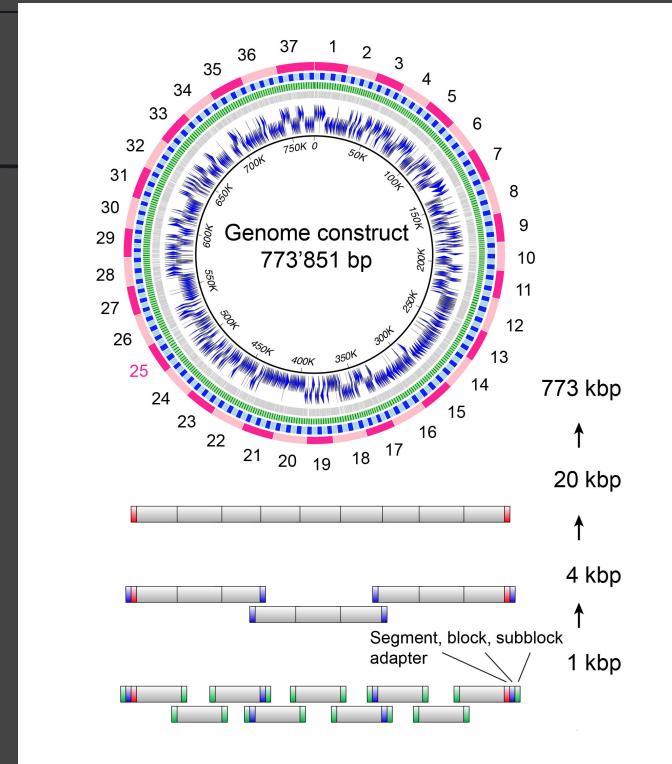
Assembly hierarchy of Sc2.0, from
Design of a synthetic yeast genome
Richardson et al., Science, 2017

SYNTHESIS
FROM
SCRATCH

Problem: assembly projects are varied and complex



Assembly hierarchy of Sc2.0, from
Design of a synthetic yeast genome
Richardson et al., Science, 2017



Genome Partitioner,
Christensen et al., PLOS One, 2017

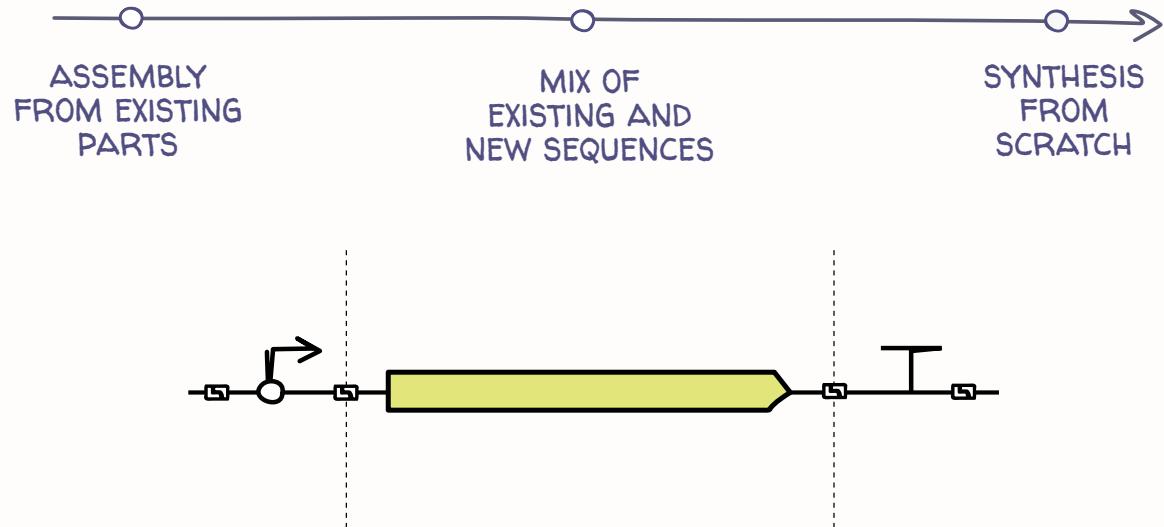
Problem: assembly projects are varied and complex



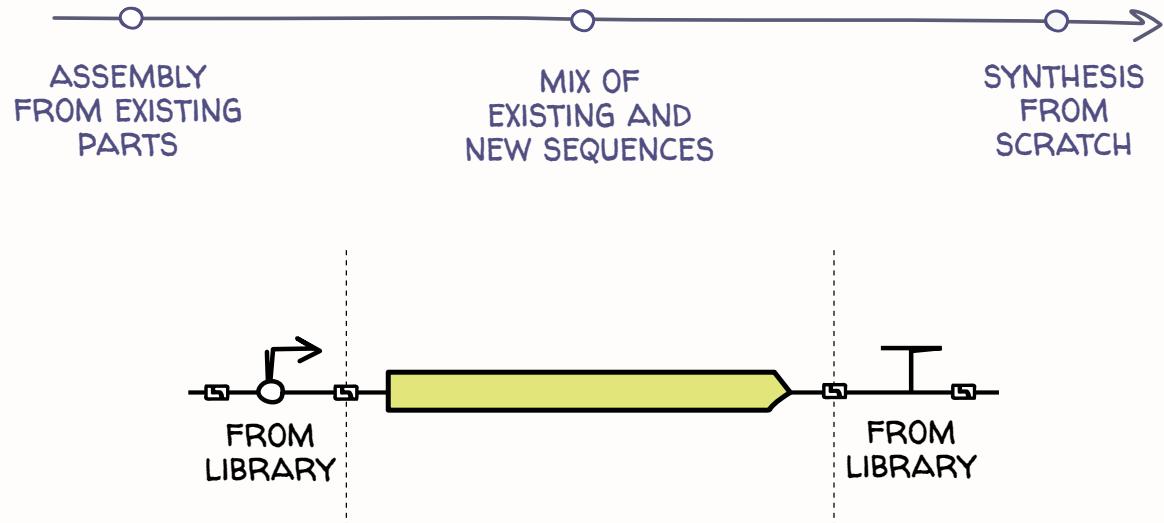
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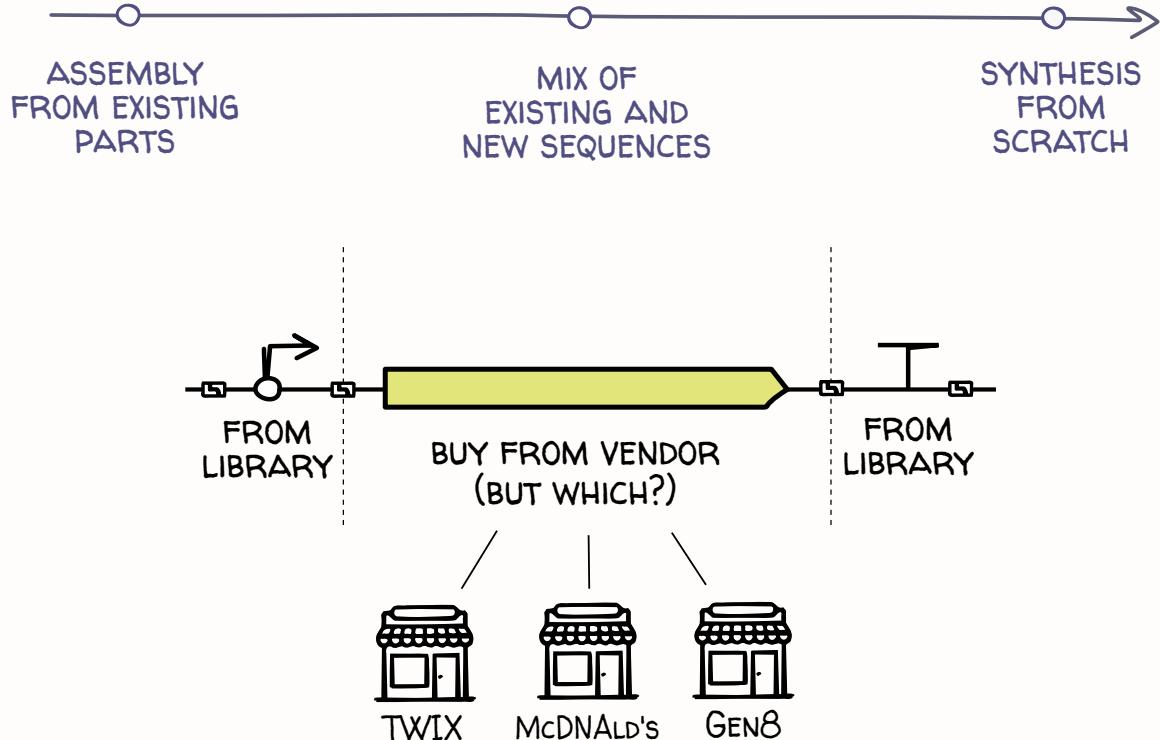
Problem: assembly projects are varied and complex



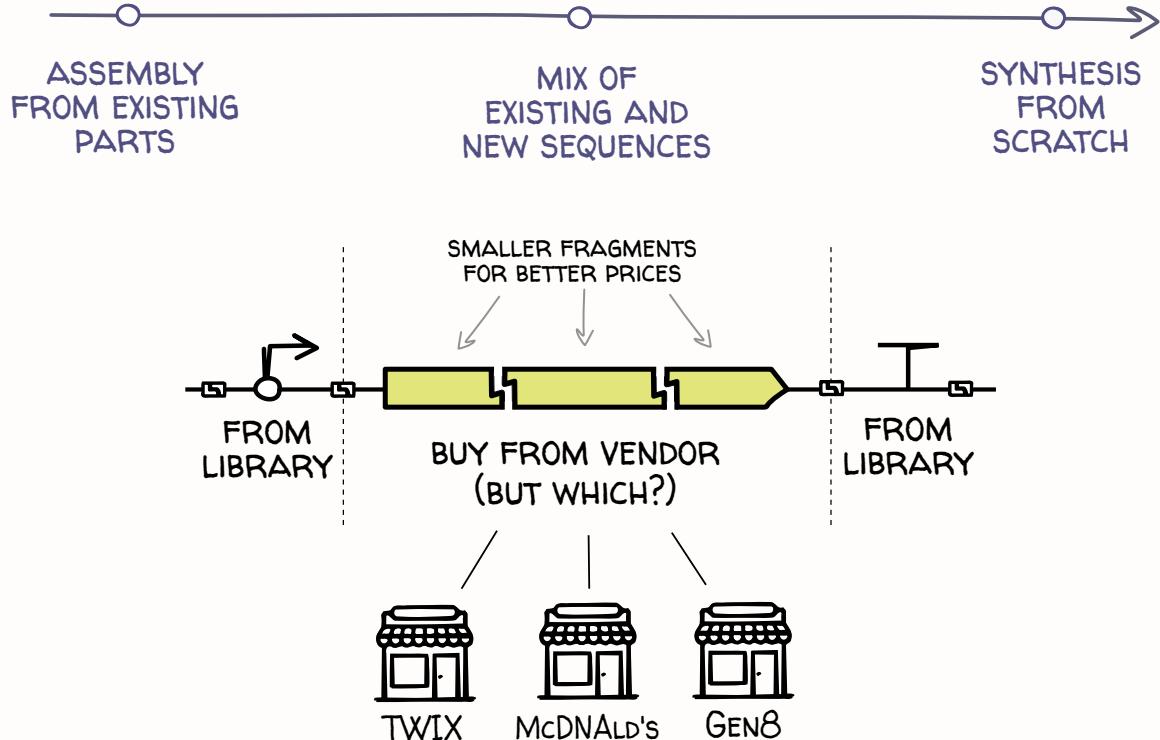
Problem: assembly projects are varied and complex



Problem: assembly projects are varied and complex



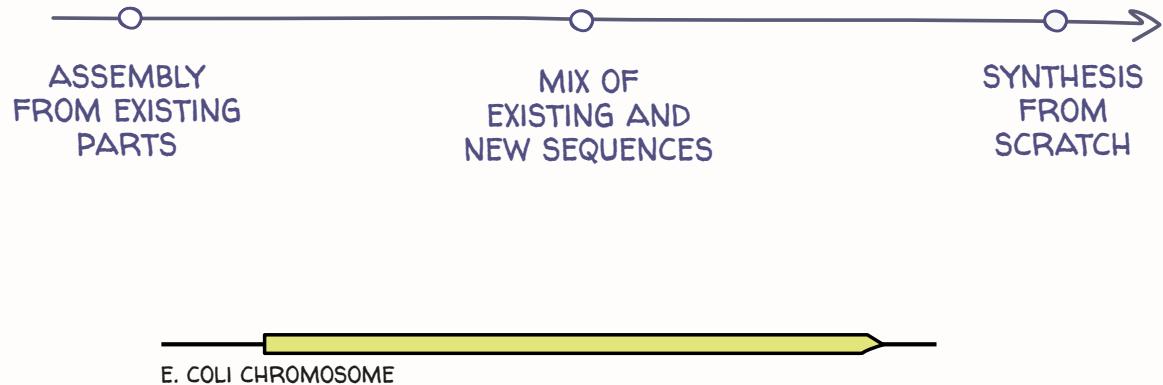
Problem: assembly projects are varied and complex



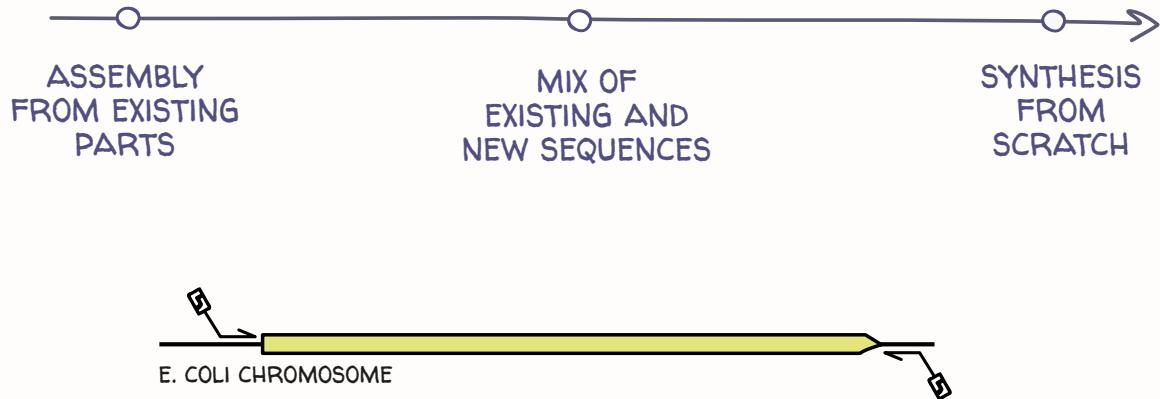
Problem: assembly projects are varied and complex



Problem: assembly projects are varied and complex



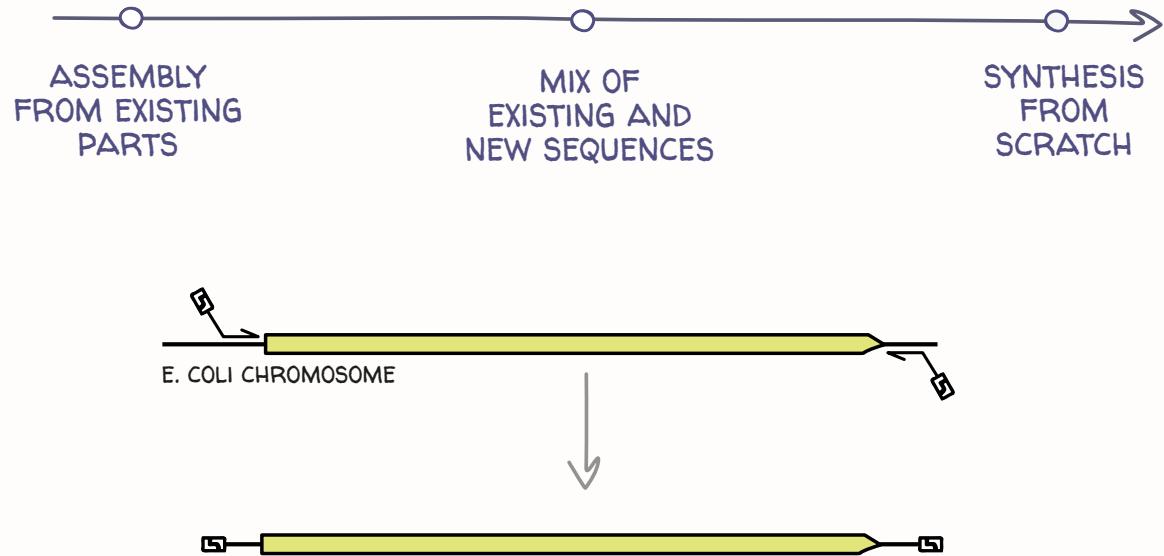
Problem: assembly projects are varied and complex



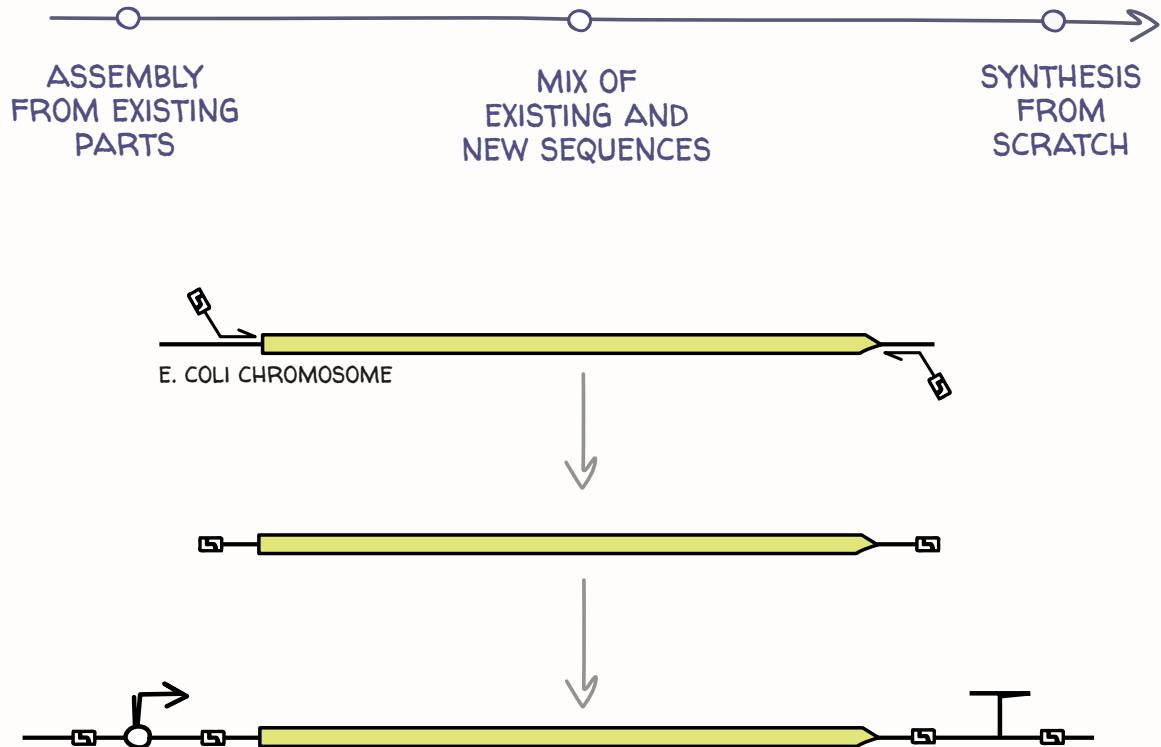
Problem: assembly projects are varied and complex



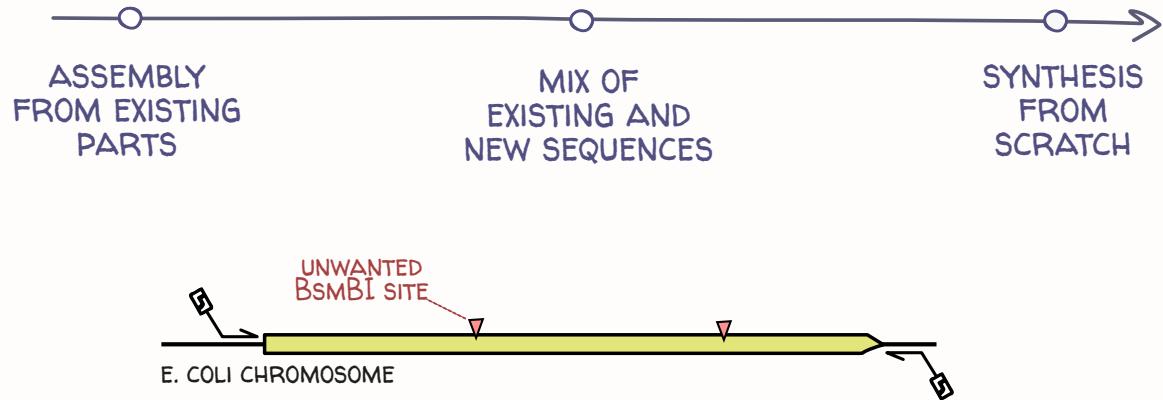
Problem: assembly projects are varied and complex



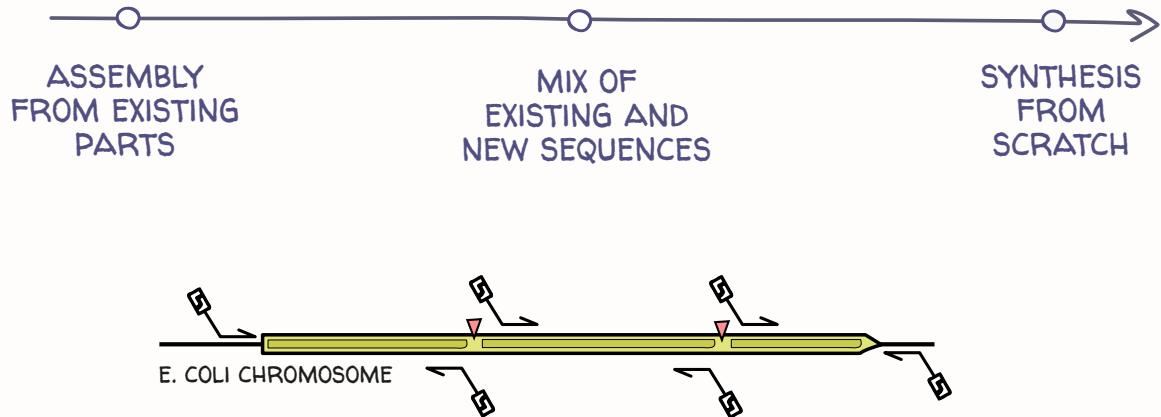
Problem: assembly projects are varied and complex



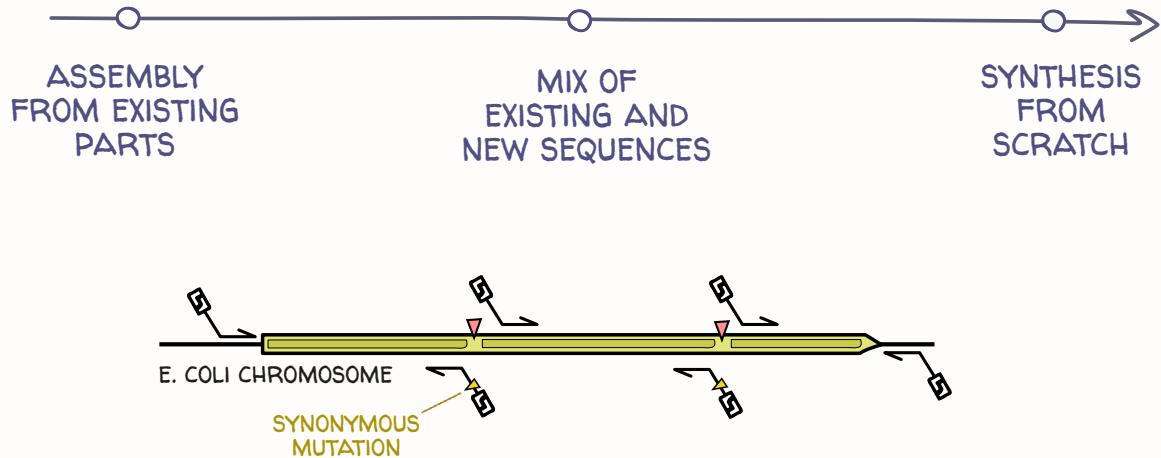
Problem: assembly projects are varied and complex



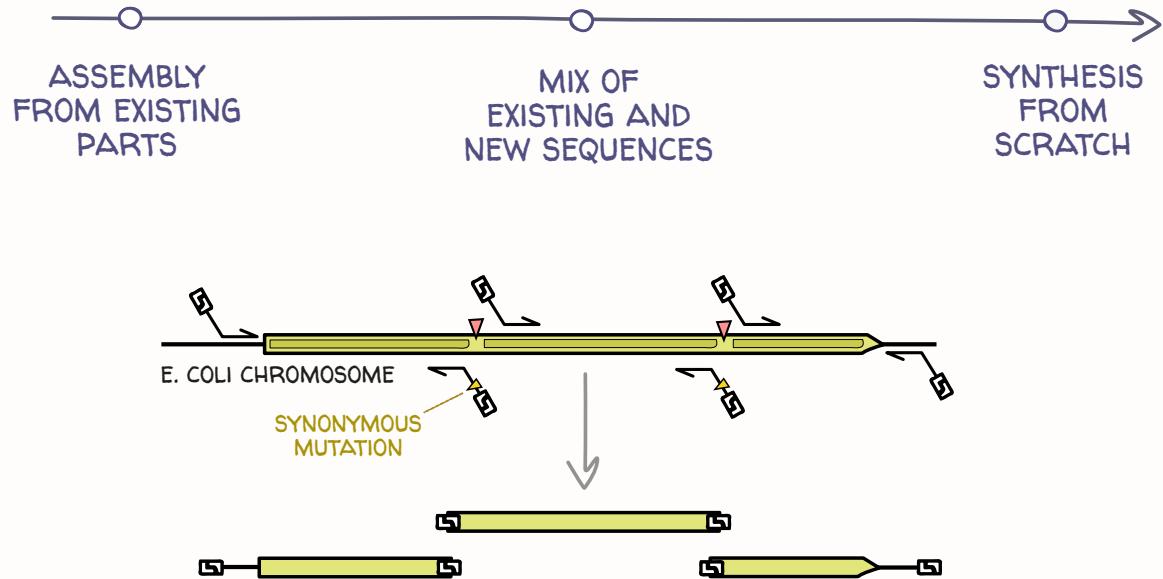
Problem: assembly projects are varied and complex



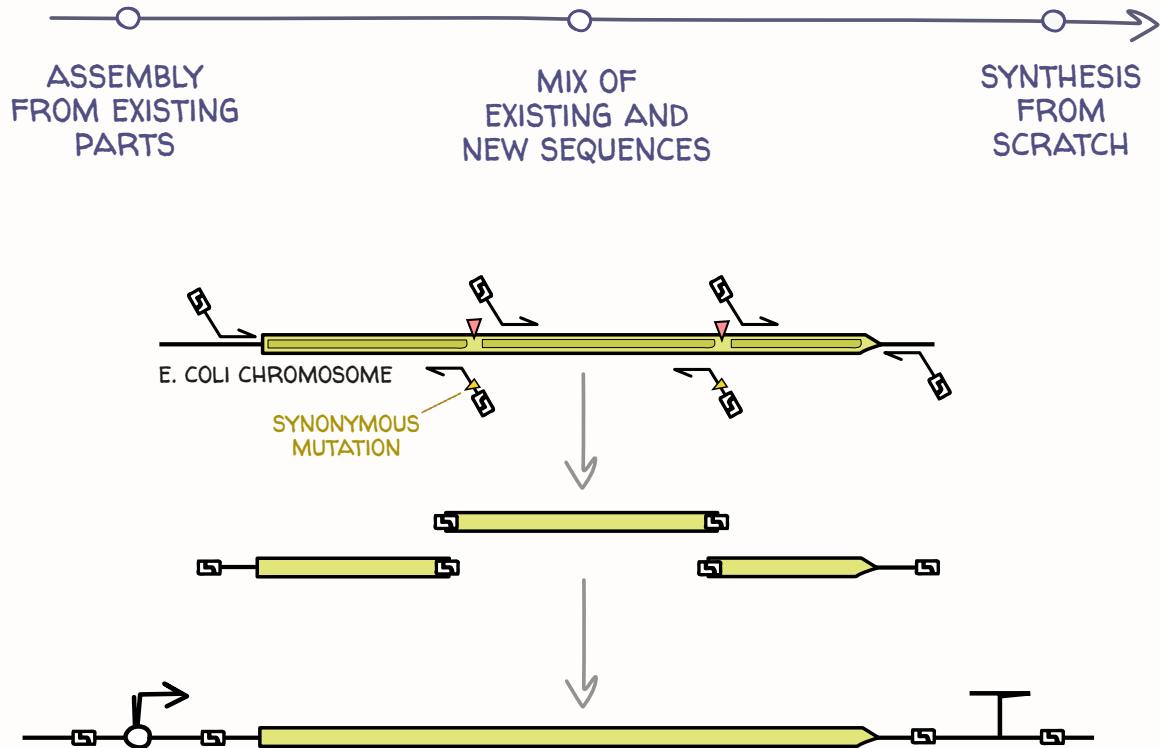
Problem: assembly projects are varied and complex



Problem: assembly projects are varied and complex

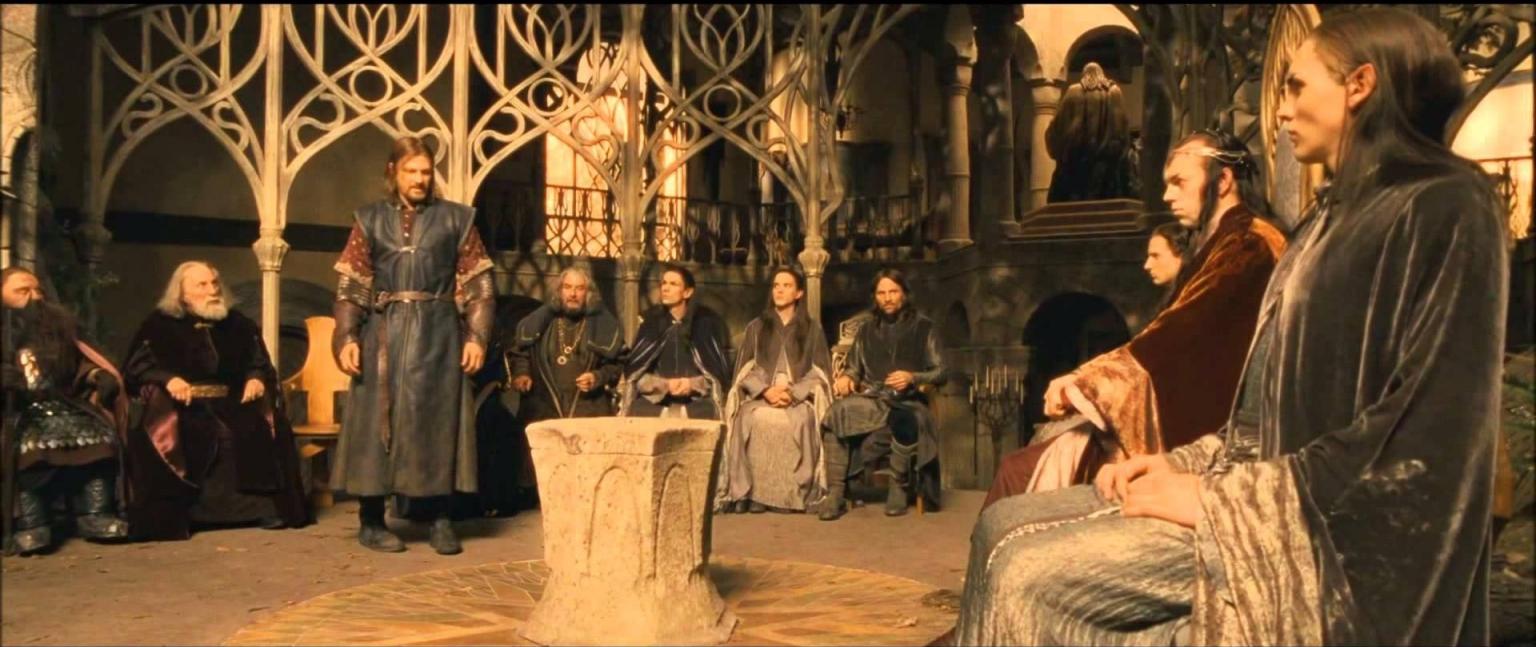


Problem: assembly projects are varied and complex

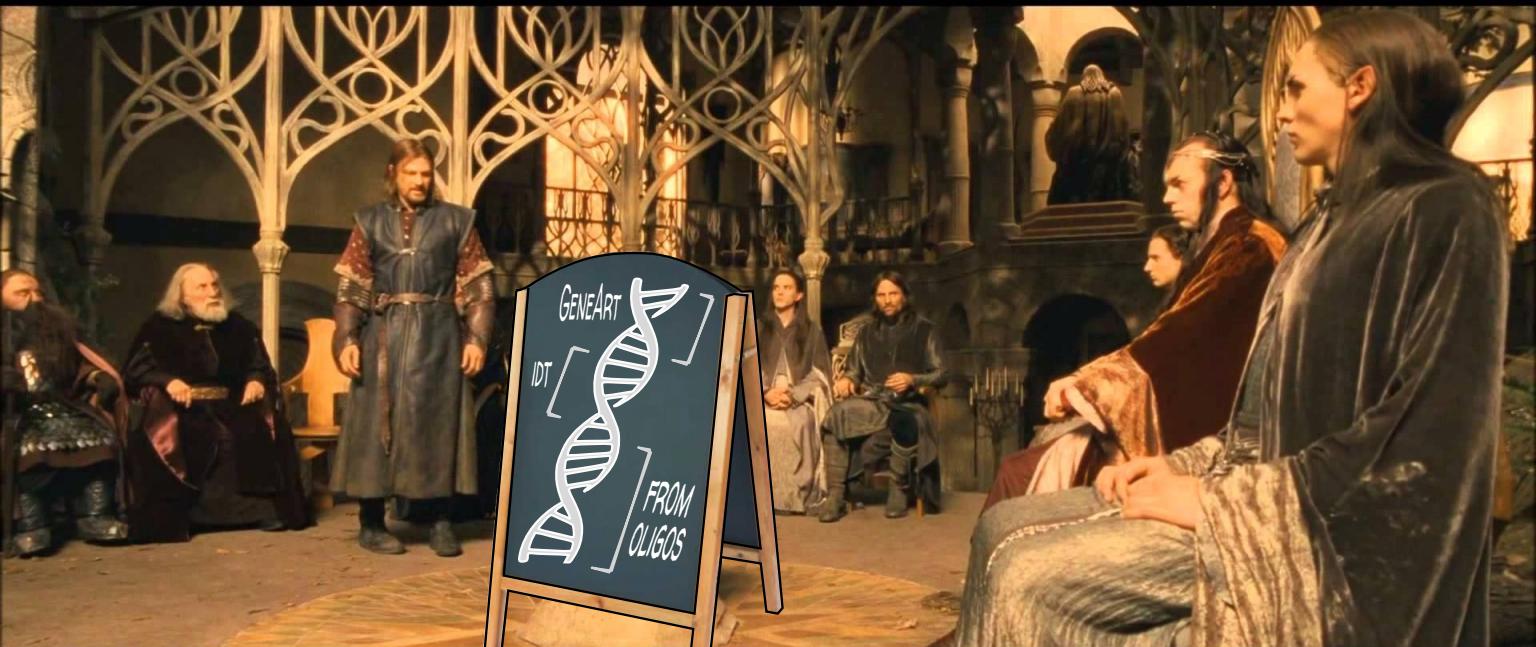


What a typical assembly strategy meeting looks like

What a typical assembly strategy meeting looks like



What a typical assembly strategy meeting looks like



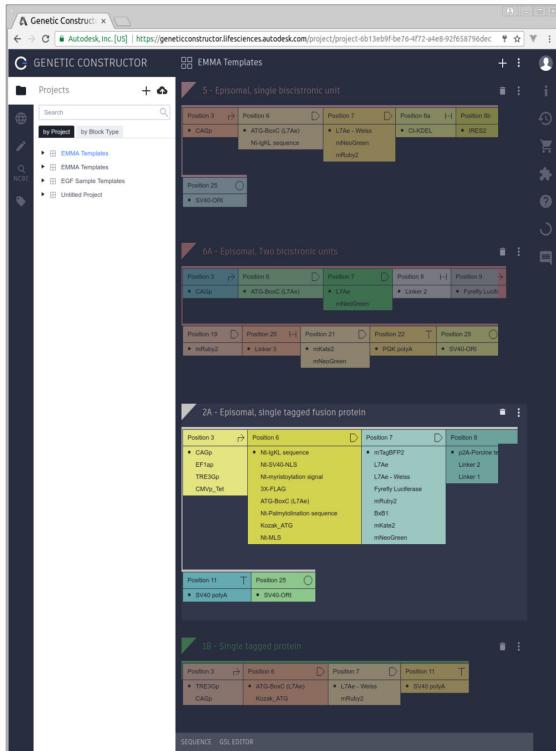
What a typical assembly strategy meeting looks like



How an ideal design-to-build portal would work

How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)

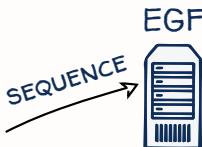


How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)

The screenshot shows the Autodesk Genetic Constructor interface with four tabs displayed:

- 5 - Episomal, single bicistronic unit**: A construct with two genes at Position 3 and Position 6, separated by a linker. It includes ATG-BsicC (L7Ae), mRFP sequence, L7Ae - Weiss mNeoGreen, and mRuby2.
- 6A - Episomal, Two bicistronic units**: Two separate constructs. The top one has genes at Position 3 and Position 6 (ATG-BsicC (L7Ae)), a linker, and L7Ae - Weiss mNeoGreen. The bottom one has genes at Position 19 and Position 20 (mRuby2), a linker, and mRFP polyA.
- 2A - Episomal, single tagged fusion protein**: A construct with genes at Position 3 and Position 6 (mRFP sequence, SV40-NLS, L7Ae, mRFP polyA signal, 3XFLAG, ATG-BsicC (L7Ae)), a linker, and L7Ae - Weiss Pyrenyl Luciferase mRuby2, Bsd1, mKate2, and mNeoGreen.
- 1B - Single tagged protein**: A construct with genes at Position 3 and Position 6 (TRE3bp, mRFP sequence, Kozak_ATG, and SV40 polyA).

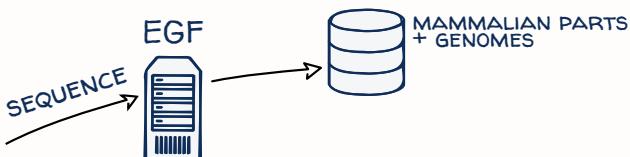


How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)

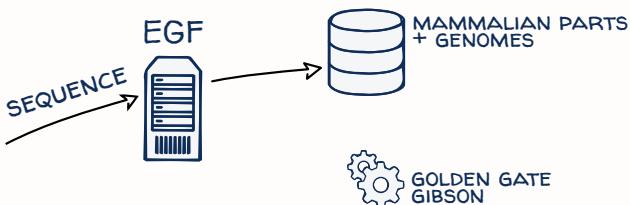
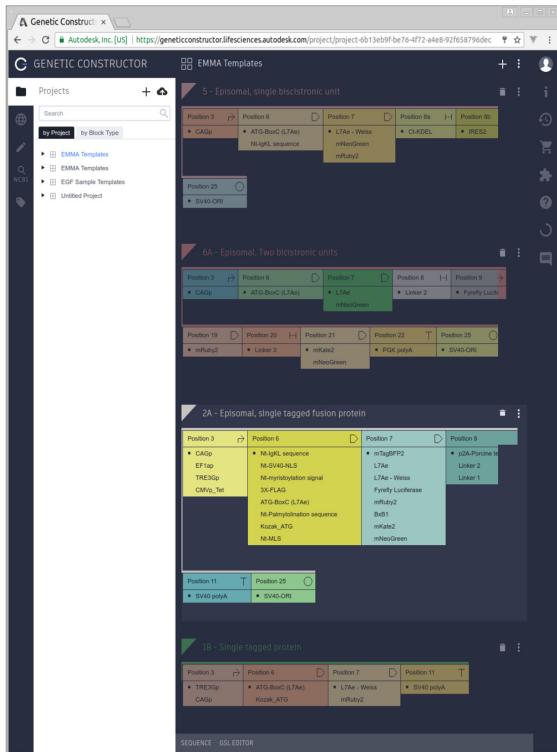
The screenshot shows the Autodesk Genetic Constructor interface with four tabs displayed:

- 5 - Episomal, single bicistronic unit:** A construct with two genes at positions 6 and 8, separated by a linker. It includes a CAG promoter at position 3, ATG-BsdC(L7Ae) at position 6, L7Ae-Weiss mNeoGreen at position 7, mRuby2 at position 8, and SV40-ORI at position 25.
- 6A - Episomal, Two bicistronic units:** Two separate constructs. The top one has a CAG promoter at position 3, ATG-BsdC(L7Ae) at position 6, L7Ae-Weiss mNeoGreen at position 7, and a linker at position 8. The bottom one has mRuby2 at position 19, Linker 2 at position 20, mRsdC at position 21, PGK polyA at position 22, and SV40-ORI at position 25.
- 2A - Episomal, single tagged fusion protein:** A construct with three genes at positions 6, 7, and 8. It includes a CAG promoter at position 3, ATG-BsdC(L7Ae) at position 6, mRsdC at position 7, and p3X-Purine linked L7Ae-Weiss Pyrolyt Luciferase mRuby2 at position 8. It also includes BeD1 and mKate2 at position 11, and SV40 polyA at position 25.
- 1B - Single tagged protein:** A construct with two genes at positions 6 and 7. It includes TRE3G at position 3, ATG-BsdC(L7Ae) at position 6, Kozak_ATG at position 7, and SV40 polyA at position 11.



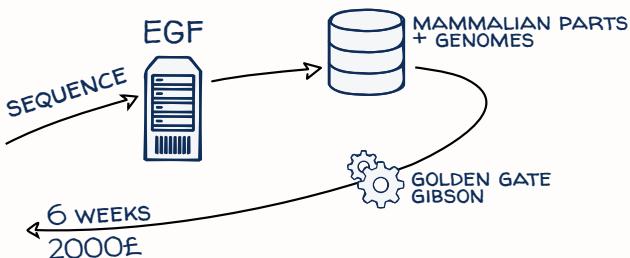
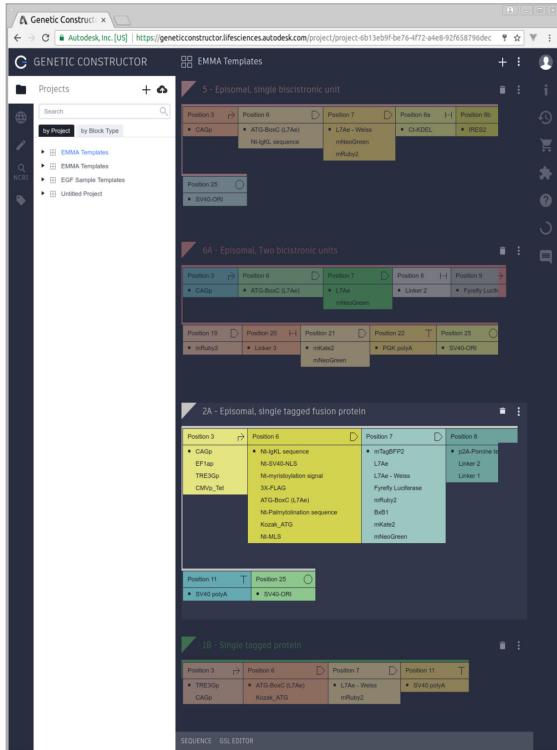
How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)



How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)



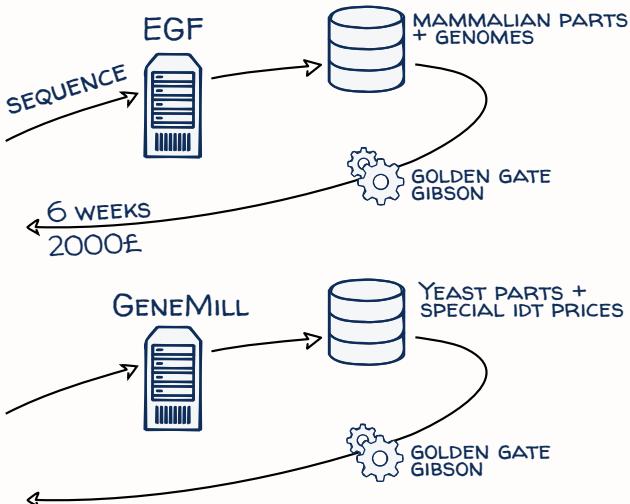
How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)

The screenshot shows the Autodesk Genetic Constructor interface with four tabs displayed:

- 5 - Epsilonomal, single bicistronic unit:** A construct with positions 3, 6, 7, 8a, and 8b. Position 3 contains a CAG promoter, position 6 contains ATG-BsdC(L7Ae), position 7 contains mNeoGreen, and position 8a contains mRuby2.
- 6A - Epsilonomal, Two bicistronic units:** A construct with positions 3, 6, 7, 8, and 9. Position 3 contains a CAG promoter, position 6 contains ATG-BsdC(L7Ae), position 7 contains mNeoGreen, position 8 contains a linker, and position 9 contains mRuby2.
- 2A - Epsilonomal, single tagged fusion protein:** A construct with positions 3, 6, 7, and 8. Position 3 contains a TRE509 promoter, position 6 contains mRuby2, position 7 contains mNeonGreen, and position 8 contains a linker.
- 1B - Single tagged protein:** A construct with positions 3, 6, 7, and 11. Position 3 contains a TRE509 promoter, position 6 contains ATG-BsdC(L7Ae), position 7 contains mRuby2, and position 11 contains SV40 polyA.

At the bottom of the interface, there are "SEQUENCE" and "GSL EDITOR" tabs.



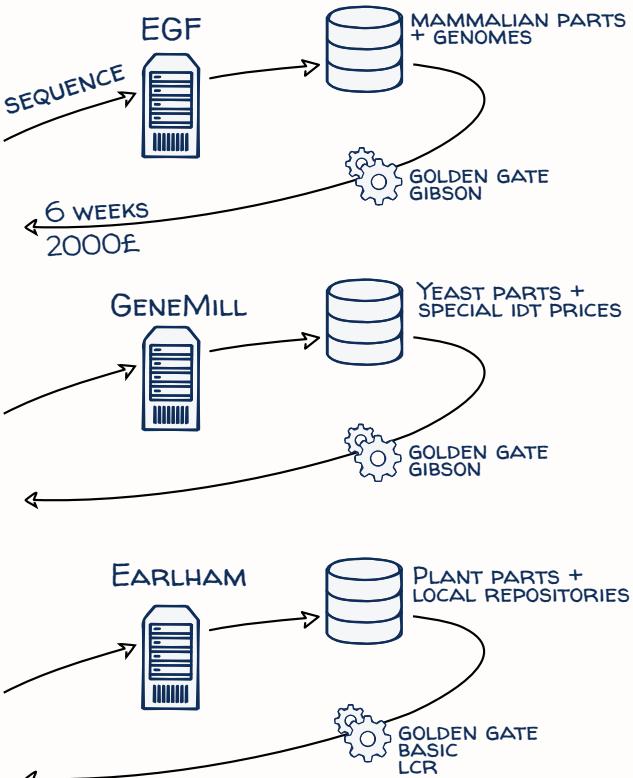
How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)

The screenshot shows the Autodesk Genetic Constructor interface with four tabs displayed:

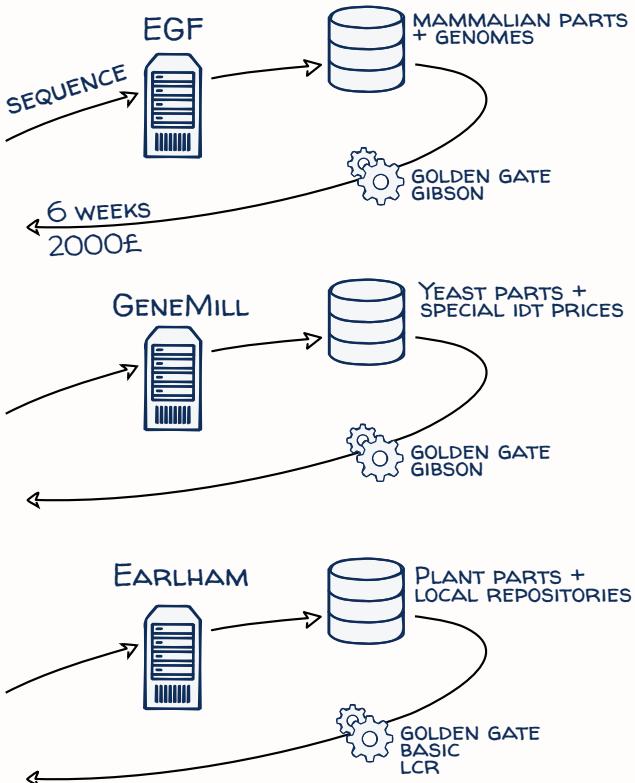
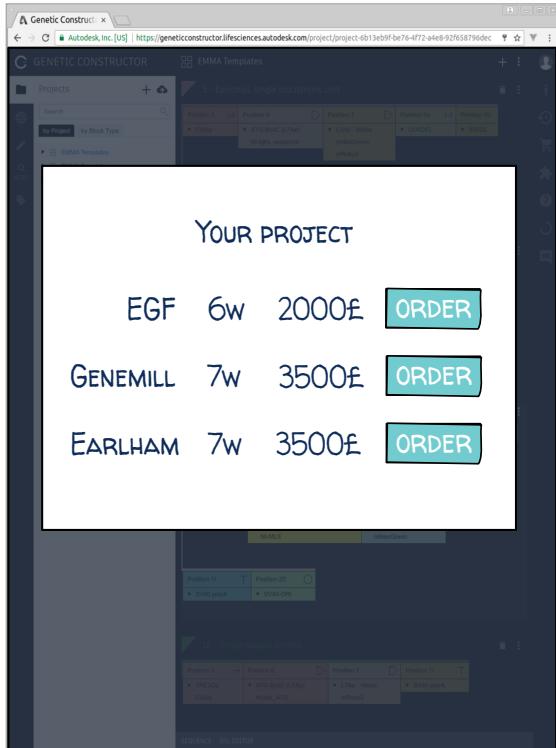
- 5 - Episomal, single bicistronic unit:** Positions 3, 6, 7, 8a, and 8b contain CAG promoter, ATG-Bsic(L7Ae), mRFP1 sequence, L7Ae - Weiss mNeonGreen, mRFP2, and C2ADEL-IRES2.
- 6A - Episomal, Two bicistronic units:** Positions 3, 6, 7, 8, and 9 contain CAG promoter, ATG-Bsic(L7Ae), mRFP1 sequence, L7Ae - Weiss mNeonGreen, and L7Ae - Weiss mRFP2.
- 2A - Episomal, single tagged fusion protein:** Positions 3, 6, 7, and 8 contain CAG promoter, EF1α, SV40 polyA signal, 3XFLAG, ATG-Bsic(L7Ae), mRFP1 sequence, Kozak_ATG, mRFP2, and SV40 polyA.
- 1B - Single tagged protein:** Positions 3, 6, 7, and 11 contain TRE35op, CAG promoter, ATG-Bsic(L7Ae), Kozak_ATG, and SV40 polyA.

At the bottom left is the "SEQUENCE" tab, and at the bottom right is the "GDS EDITOR" tab.



How an ideal design-to-build portal would work

AUTODESK GENETIC CONSTRUCTOR (-2018)



Automated assembly planning with DNA Weaver

Automated assembly planning with DNA Weaver

Given a DNA sequence, DNA Weaver automatically devises an optimal assembly strategies accounting for:

Automated assembly planning with DNA Weaver

Given a DNA sequence, DNA Weaver automatically devises an optimal assembly strategies accounting for:

- Your lab's preferred assembly techniques

Automated assembly planning with DNA Weaver

Given a DNA sequence, DNA Weaver automatically devises an optimal assembly strategies accounting for:

- Your lab's preferred assembly techniques
- Your available DNA sources (vendors, libraries)

Automated assembly planning with DNA Weaver

Given a DNA sequence, DNA Weaver automatically devises an optimal assembly strategies accounting for:

- ▶ Your lab's preferred assembly techniques
- ▶ Your available DNA sources (vendors, libraries)
- ▶ Your budget and time constraints.

Automated assembly planning with DNA Weaver

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It can be used as:

Automated assembly planning with DNA Weaver

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It can be used as:

- A Python framework (for scripts or web servers)

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It can be used as:

- ▶ A Python framework (for scripts or web servers)
- ▶ An interactive web interface

Automated assembly planning with DNA Weaver

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It is free, open-source (MIT), easily extensible.

Automated assembly planning with DNA Weaver

Given a DNA sequence, DNA Weaver automatically devises an optimal assembly strategies accounting for:

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It is free, open-source (MIT), easily extensible.



dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

 DNA
WEAVER

Load and example

You 

Optimization Cheapest plan

Upload a sequence


Drop a file here or click to upload

sequence_with_emma_and_ecoli_parts.txt

Compute an assembly plan

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dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA
WEAVER

Load and example

Golden Gate| ↙

You

Optimization Cheapest plan

Upload a sequence

Drop a file here or [click to upload](#)

sequence_with_emma_and_ecoli_parts.txt

Compute an assembly plan

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The EGF is supported by the Research Councils UK and the University of Edinburgh

A screenshot of a web browser window displaying the dnaweafer-webapp. The page features a logo with a blue grid icon and the text 'DNA WEAVER'. Below the logo are three circular icons with arrows pointing up, down, and left, followed by a 'Load and example' button. A sequence assembly plan is shown, starting with 'Golden Gate' at the top, followed by a small flask icon, a horizontal line, and a user icon labeled 'You'. A blue arrow points to the flask icon. Below the assembly plan are two dropdown menus: 'Optimization' set to 'Cheapest plan' and 'Upload a sequence'. A dashed box contains a cloud icon with an upward arrow and the text 'Drop a file here or click to upload'. A file named 'sequence_with_emma_and_ecoli_parts.txt' is listed with a green circular icon next to it. At the bottom is a 'Compute an assembly plan' button. The footer of the page includes the copyright notice '© Edinburgh Genome Foundry, 2017' and information about support from the Research Councils UK and the University of Edinburgh.

dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

Golden Gate

Assembly Parameters

Cost (\$) 20

Duration (days) 7

Method Type IIS (Golden Gate)

Enzyme BsmBI

Limit Construct Size

Fragments size 100  5000

Solver Parameters

Grain Auto

Use A*

Compute an assembly plan

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dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

EMMA 

Golden Gate

You

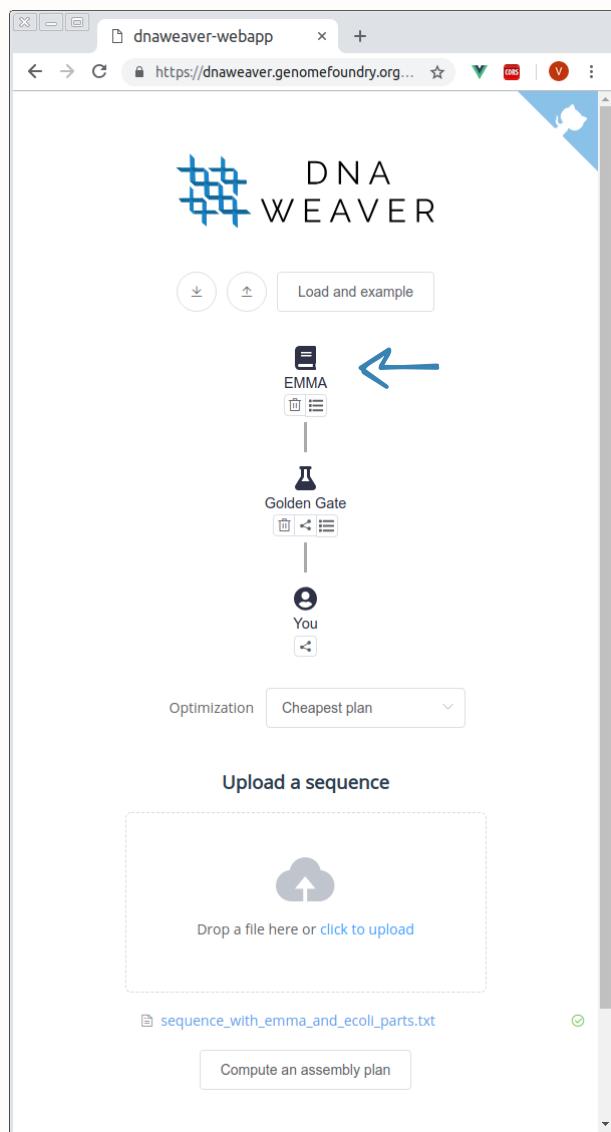
Optimization Cheapest plan

Upload a sequence

Drop a file here or [click to upload](#)

sequence_with_emma_and_ecoli_parts.txt

Compute an assembly plan



dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

EMMA TwixDNA ←

Golden Gate

You

Optimization Cheapest plan

Upload a sequence

Drop a file here or click to upload

sequence_with_emma_and_ecoli_parts.txt

Compute an assembly plan

The screenshot shows the dnaweafer-webapp interface. At the top, there's a navigation bar with a back arrow, forward arrow, refresh button, and a URL field. Below the header is the DNA Weaver logo. Underneath the logo are three buttons: a downward arrow, an upward arrow, and a 'Load and example' button. A blue arrow points to the 'TwixDNA' node in the workflow diagram. The workflow diagram consists of several nodes connected by arrows: 'EMMA' (with a trash bin icon), 'TwixDNA' (with a shopping cart icon), 'Golden Gate' (with a flask icon), and 'You' (with a person icon). Below the diagram are two dropdown menus: 'Optimization' set to 'Cheapest plan' and 'Upload a sequence'. A dashed box contains a cloud icon with an upward arrow and the text 'Drop a file here or click to upload'. Below this box is a file name: 'sequence_with_emma_and_ecoli_parts.txt'. At the bottom is a 'Compute an assembly plan' button.

dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

EMMA TwixDNA

Lead time (days) 10

Cost (\$/bp) 0.6

Size range (bp) 100 5000

Valid GC% 20 80

Forbidden patterns

Optimization Cheapest plan

Upload a sequence

Drop a file here or click to upload

sequence_with_emma_and_ecoli_parts.txt

Compute an assembly plan

63

dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

The DNA Weaver interface shows a vertical assembly plan. At the top is the 'EMMA' node, followed by the 'TwixDNA' node, then the 'Golden Gate' node, and finally the 'You' node at the bottom. Arrows indicate the flow from EMMA to TwixDNA, TwixDNA to Golden Gate, and Golden Gate to You. A blue arrow points to the 'Oligo Assembly' node, which is positioned to the right of the main vertical line. The 'Oligo Assembly' node has its own set of arrows pointing downwards towards the main assembly line.

EMMA

TwixDNA

Golden Gate

You

Oligo Assembly

Optimization Cheapest plan

Upload a sequence

Drop a file here or click to upload

sequence_with_emma_and_ecoli_parts.txt

Compute an assembly plan

dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

Oligos.com

EMMA

TrixDNA

Golden Gate

You

Optimization Cheapest plan

Upload a sequence

Drop a file here or [click to upload](#)

dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

EMMA

TwixDNA

Oligo Assembly

PCR station

Golden Gate

You

Optimization Cheapest plan

Upload a sequence

Drop a file here or [click to upload](#)

dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

DNA WEAVER

Load and example

The interface features a central tree diagram with nodes for EMMA, TwixDNA, Golden Gate, Oligo Assembly, and PCR station, all connected to a 'You' node at the bottom. Above the tree are links to Oligos.com, TwixDNA, and Oligo Assembly. Below the tree is an 'Optimization' dropdown set to 'Cheapest plan'. At the bottom is a large dashed box for sequence upload, containing a cloud icon and the text 'Upload a sequence' and 'Drop a file here or click to upload'.

EMMA

TwixDNA

Golden Gate

Oligo Assembly

PCR station

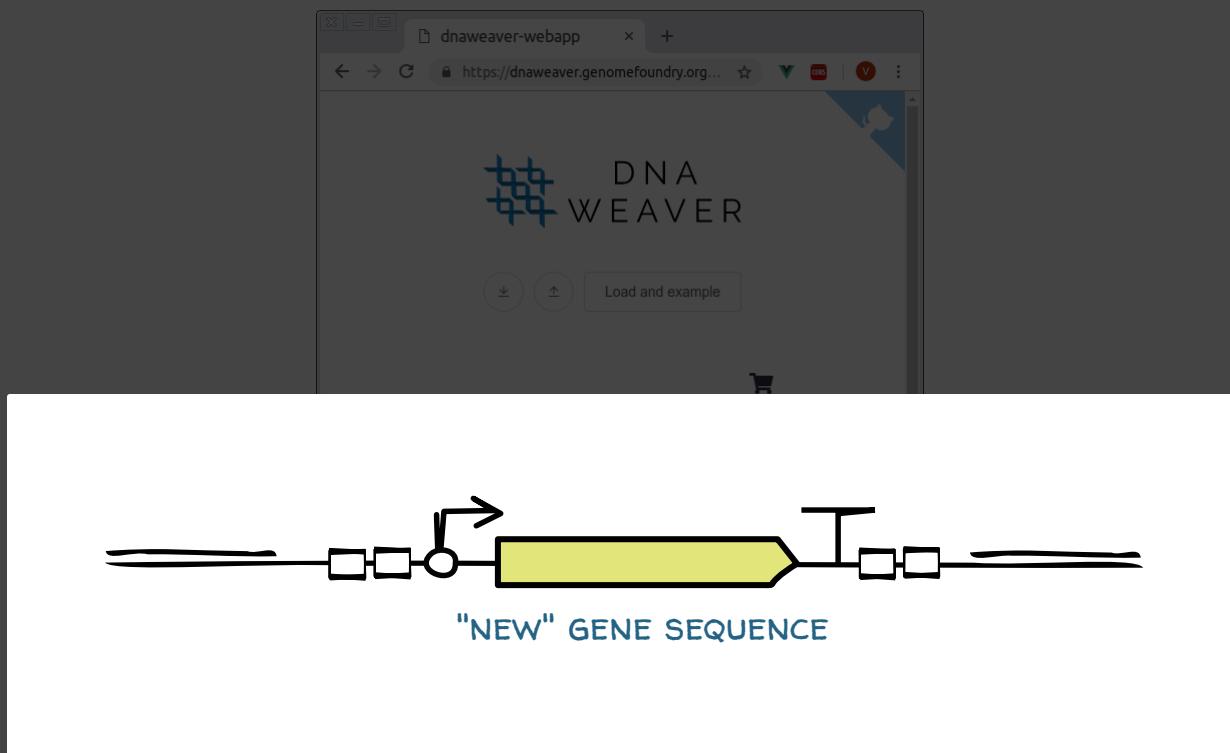
Oligos.com

You

Optimization Cheapest plan

Upload a sequence

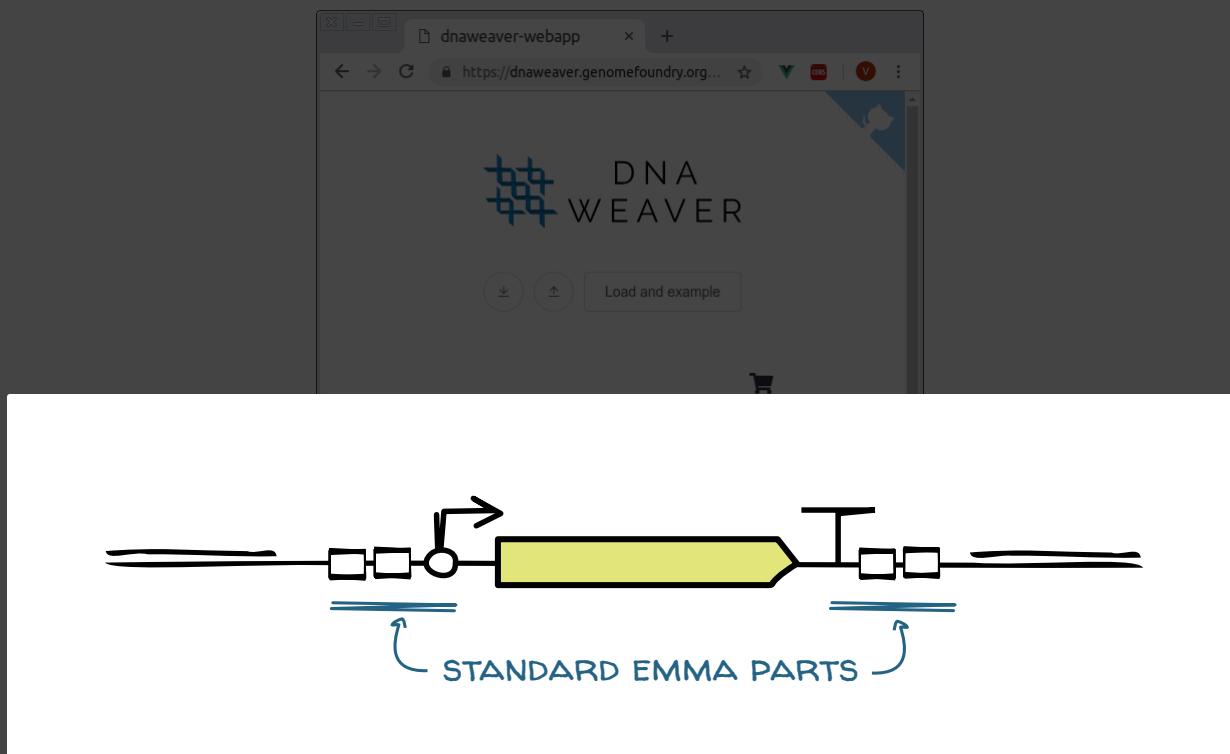
Drop a file here or [click to upload](#)



Optimization Cheapest plan

Upload a sequence

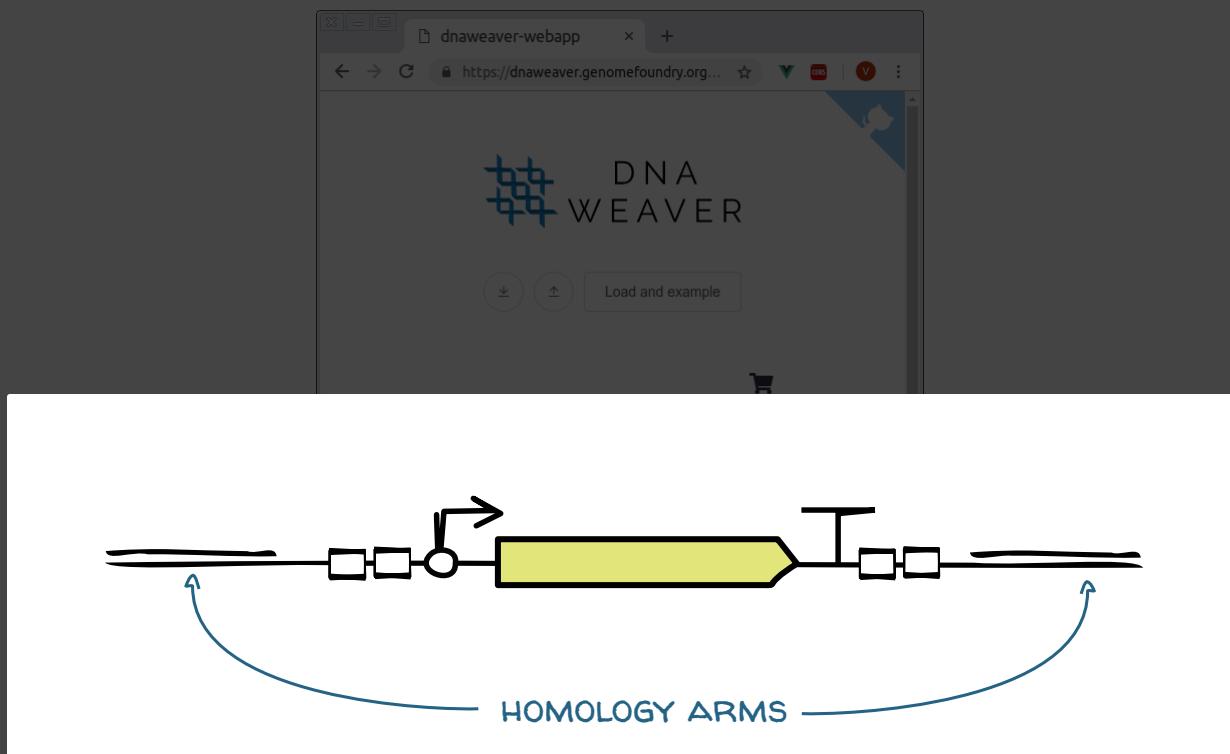
Drop a file here or click to upload



Optimization

Upload a sequence

Drop a file here or [click to upload](#)



Optimization Cheapest plan

Upload a sequence



Drop a file here or [click to upload](#)

dnaweafer-webapp <https://dnaweafer.genomefoundry.org...>

Upload a sequence

Drop a file here or [click to upload](#)

sequence_with_emma_and_ecoli_parts.txt

Compute an assembly plan

Assembly Plan

Total cost: 1342 \$

Lead time: 17 days

Complexity: 14 operations

[Full assembly report](#)

Legend:

- EMMA (green)
- Ecoli PCR station (pink)
- Company (blue)
- Oligos company (light blue)

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PCR Re-use

DNA WEAVER

Assembly Strategy Report

Using DNA-Weaver version

Overview

Sequence		Assembly	
Name: unknown		Duration: 17 days	
User: unknown		Cost: 13422 \$	
On date: 2019/06/25		Commercial orders: 5 (1314.2 \$)	
Length: 5277 bp			
Hash: -f4996cf40d5a123			

Orders

Orders from Oligos.com

ID	Length	Price	Lead time	Location
S00000	36	7.2	5	1.1K
S00001	35	7.0	5	361.1K
S00010	37	7.4	5	437.1K
S00011	34	6.8	5	530.5K

Orders from TwixDNA

ID	Length	Price	Lead time	Location
S00006	2143	1285.8	10	140.2K

PCR Re-use

sequence

or click to upload

a_and_ecoli_parts.txt

assembly plan

Assembly Plan

Cost: 1342 \$

Time: 17 days

14 operations

Assembly report

Page 2 of 2

Company

Oligos company

Page 1 of 2

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dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

PCR Re-use

DNA WEAVER

Assembly Strategy Report

Using DNA-Weaver version

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Sequence		Assembly	
Name: unknown		Duration: 17 days	
User: unknown		Cost: 13422 \$	
On date: 2019/06/25		Commercial orders: 5 (1314.2 \$)	
Length: 5277 bp			
Hash: -f4996cf40d5a123			

Orders

Orders from Oligos.com

ID	Length	Price	Lead time	Location
S00000	36	7.2	5	11K
S00001	35	7.0	5	3611K
S00010	37	7.4	5	43781K
S00011	34	6.8	5	53501K

Orders from TwixDNA

ID	Length	Price	Lead time	Location
S00006	2143	1285.8	10	1000 2019

PCR Re-use

Assembly Plan

Cost: 1342 \$

Time: 17 days

14 operations

Assembly report

Page 2 of 2

Company

Oligos company

Page 1 of 2

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PCR Re-use

DNA WEAVER

Assembly Strategy Report

Using DNA-Weaver version

Overview

Sequence		Assembly	
Name: unknown		Duration: 17 days	
User: unknown		Cost: 13422 \$	
On date: 2019/06/25		Commercial orders: 5 (1314.2 \$)	
Length: 5277 bp			
Hash: -1f4996cf40d5a123			

Orders

Orders from Oligos.com

ID	Length	Price	Lead time	Location
S00000	36	7.2	5	1.1K
S00001	35	7.0	5	361.1K
S00010	37	7.4	5	437.1K
S00011	34	6.8	5	530.5K

Orders from TwixDNA

ID	Length	Price	Lead time	Location
S00006	2143	1285.8	10	100.3K

PCR Re-use

PCR station

EMMA

TwixDNA

Oligos.com

S00011
S00010

S00012

S00009
S00008
S00007
S00006
S00005
S00004
S00003

S00001
S00000

S00002

S00014

Page 2 of 2

Company

Oligos company

Page 1 of 2

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dnaweafer-webapp https://dnaweafer.genomefoundry.org... +

PCR Re-use

DNA WEAVER

Assembly Strategy Report

Overview

Sequence		Assembly	
Name: unknown		Duration: 17 days	
User: unknown		Cost: 13422 \$	
On date: 2019/06/25		Commercial orders: 5 (1314.2 \$)	
Length: 5277 bp			
Hash: -f4996cf40d5a123			

Orders

Orders from Oligos.com

ID	Length	Price	Lead time	Location
S00000	36	7.2	5	1.1K
S00001	35	7.0	5	4K-10K
S00010	37	7.4	5	5K-10K
S00011	34	6.8	5	5K-10K

Orders from TwixDNA

ID	Length	Price	Lead time	Location
S00006	2143	1285.8	10	10K-20K

Using DNA-Weaver version

PCR station

Oligos.com

EMMA

TwixDNA

S00011
S00010

S00012
S00009
S00008
S00007
S00006
S00005
S00004
S00003

S00001
S00000

S00002
S00014

Page 2 of 2

Page 1 of 2

Com Oligo

ID	Type	Source	SequenceLength	Sequence
S00003	EMMA		62	CGCTCTNATGGACTGGTCGTTGGAATCTCACTT
S00004	EMMA		114	CGTCTCNGCTATGATGAGGATGTTGGAGAG
S00005	EMMA		565	CGTCTCNCTACCGTTACAATTACCGTAAATGGG
S00007	EMMA		279	CGTCTCNCCCTCTGGGTTGCAAATGACCAC
S00008	EMMA		114	CGTCTCNGCTGCACATAATCCACCATCACATGCA
S00009	EMMA		114	CGTCTCNCGAACACATATTGATCTCGTCACAAC
S00014	Golden Gate		5277	TAGGATTGGCCTGGCACCGCAGATCAGCCAACT
S00000	Oligos.com		36	CGTCTCATAGGATTGGCCTGGCACCGCAGATCAG
S00001	Oligos.com		35	CGTCTCACCATACATTCTGCGTAATACCTGGAA
S00010	Oligos.com		37	CGTCTCACTGAGGGCAGGCCATCGTCATCCA
S00011	Oligos.com		34	CGTCTCATGATGAGGCTACTTCATCAAGAA
S00002	PCR station		1022	CGTCTCATGGATTGGCCTGGCACCGCAGATCAG
S00012	PCR station		1022	CGTCTCACTGAGGGCAGGCCATCGTCATCCA
S00006	TwixDNA		2143	CGTCTCAGCAAATGCCAGACAAACACAAACTAAA

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Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION

Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



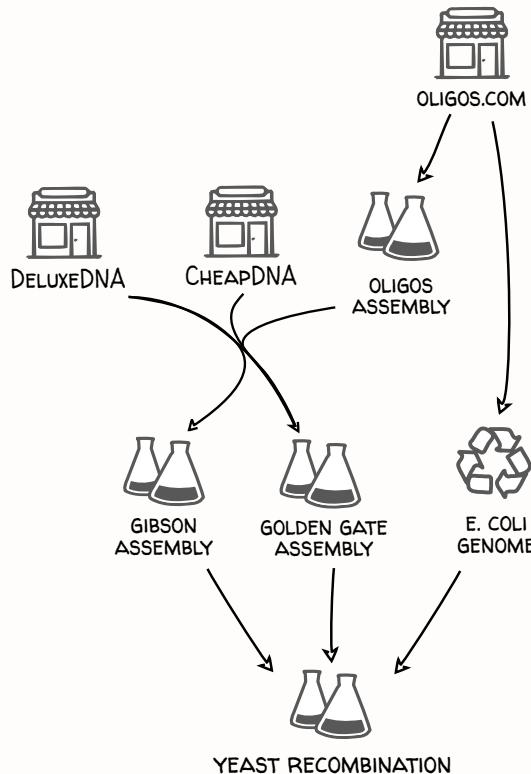
ADAPTER



PCR LINEARISATION

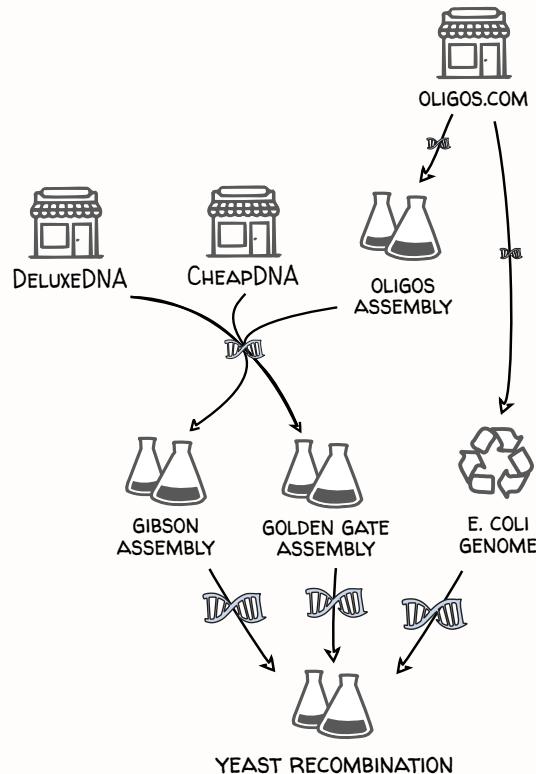
Types of DNA sources supported in DNA Weaver

- DNA VENDOR
- PARTS LIBRARY
- PCR EXTRACTION
- COMPARATOR
- DNA ASSEMBLY
- ADAPTER
- PCR LINEARISATION



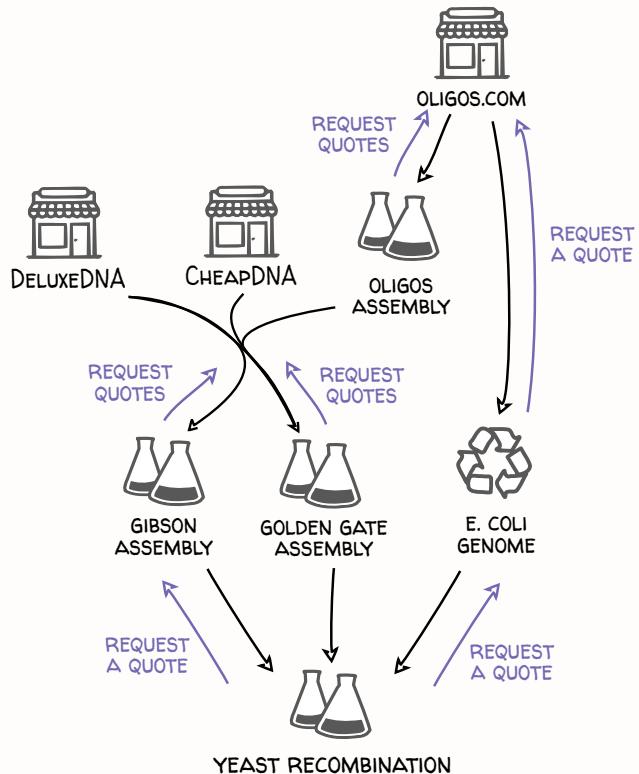
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Types of DNA sources supported in DNA Weaver

- DNA VENDOR
- PARTS LIBRARY
- PCR EXTRACTION
- COMPARATOR
- DNA ASSEMBLY
- ADAPTER
- PCR LINEARISATION



Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION

Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION



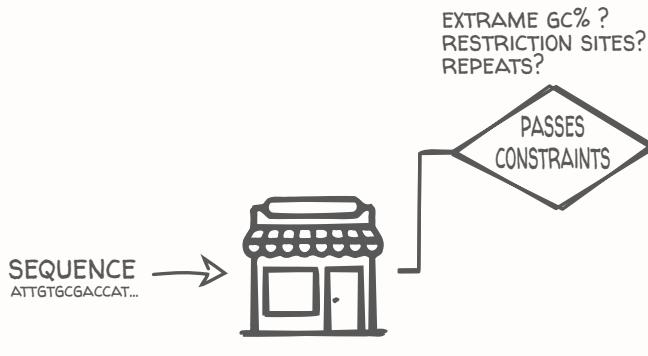
Types of DNA sources supported in DNA Weaver

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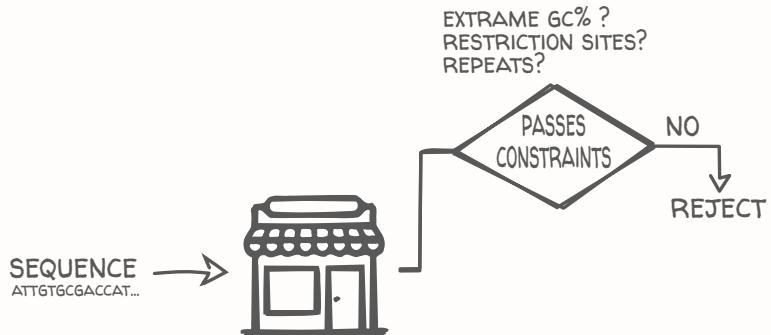


Types of DNA sources supported in DNA Weaver

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-  DNA ASSEMBLY
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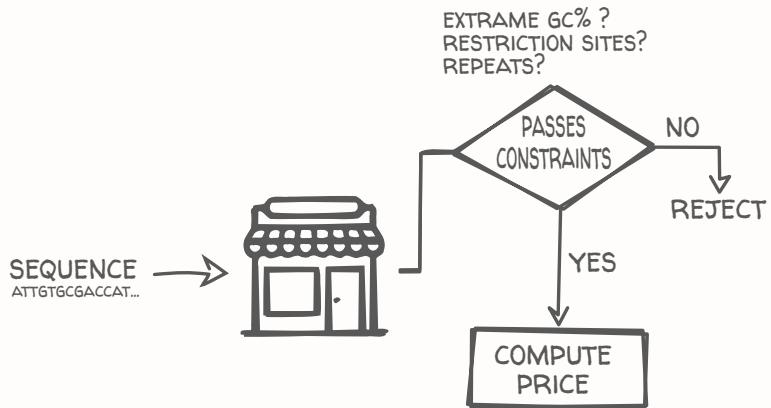


Types of DNA sources supported in DNA Weaver



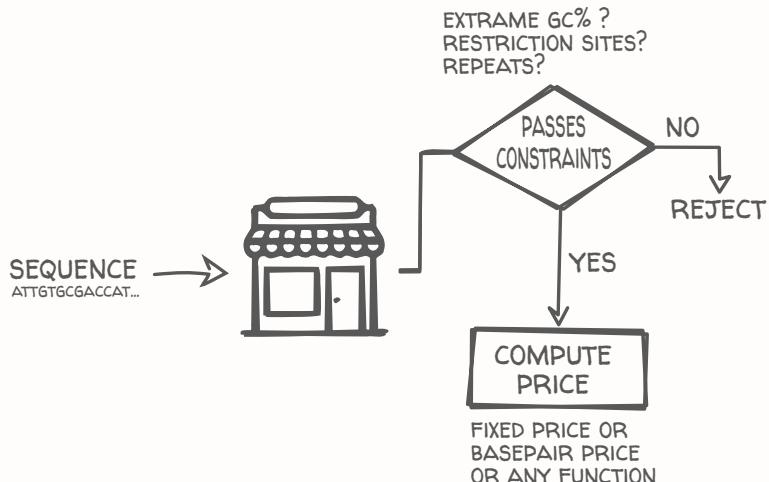
Types of DNA sources supported in DNA Weaver

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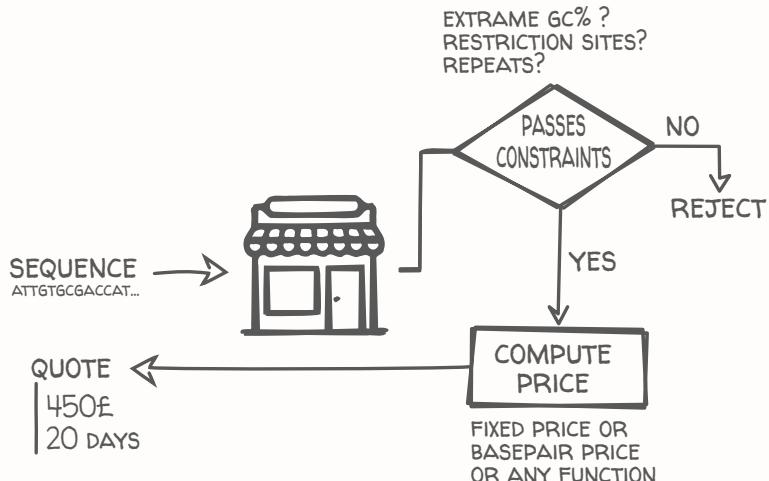
Types of DNA sources supported in DNA Weaver

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Types of DNA sources supported in DNA Weaver

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- ADAPTER
- PCR LINEARISATION



Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION

Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



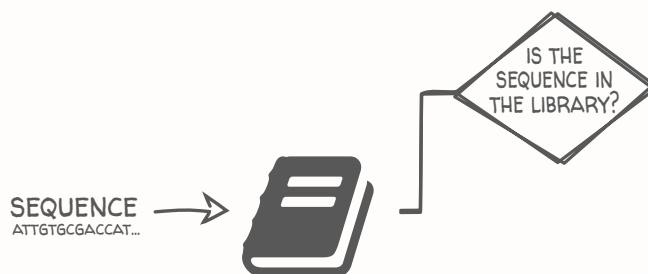
ADAPTER



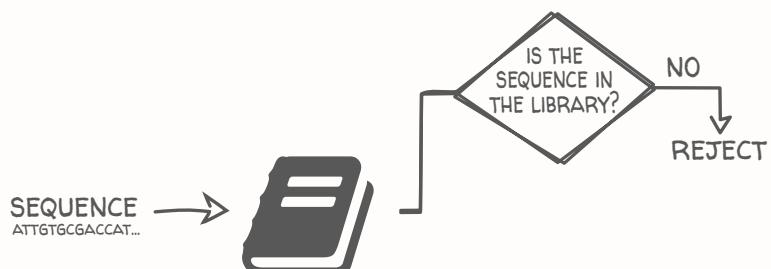
PCR LINEARISATION



Types of DNA sources supported in DNA Weaver

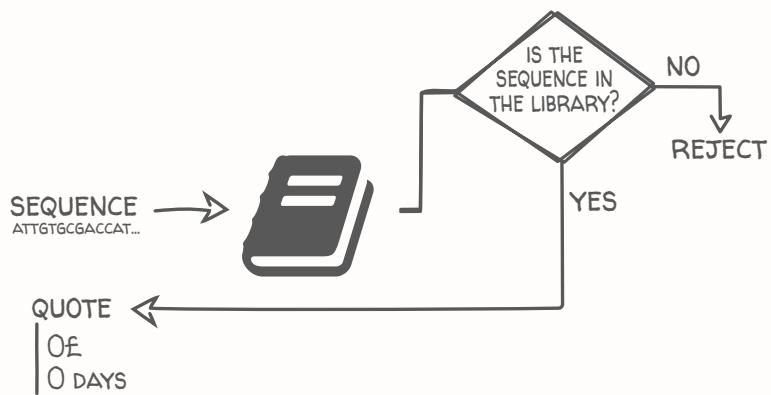


Types of DNA sources supported in DNA Weaver



Types of DNA sources supported in DNA Weaver

- DNA VENDOR
- PARTS LIBRARY
- PCR EXTRACTION
- COMPARATOR
- DNA ASSEMBLY
- ADAPTER
- PCR LINEARISATION



Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION

Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



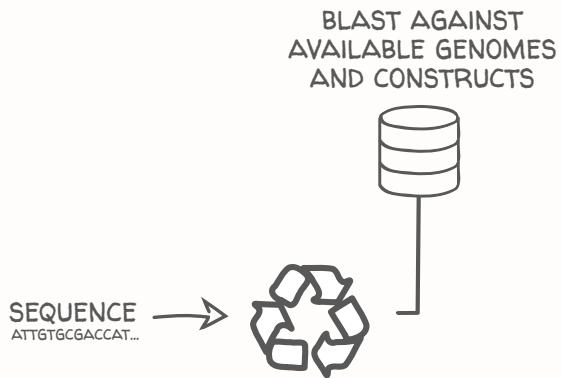
ADAPTER



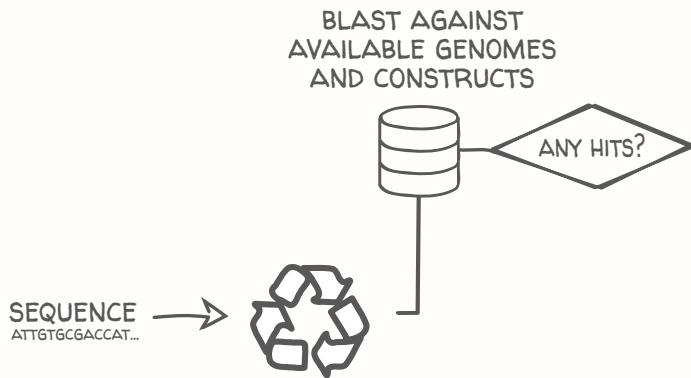
PCR LINEARISATION



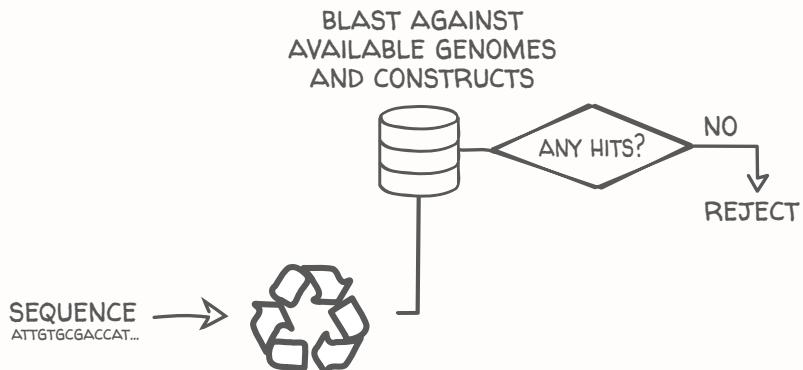
Types of DNA sources supported in DNA Weaver



Types of DNA sources supported in DNA Weaver

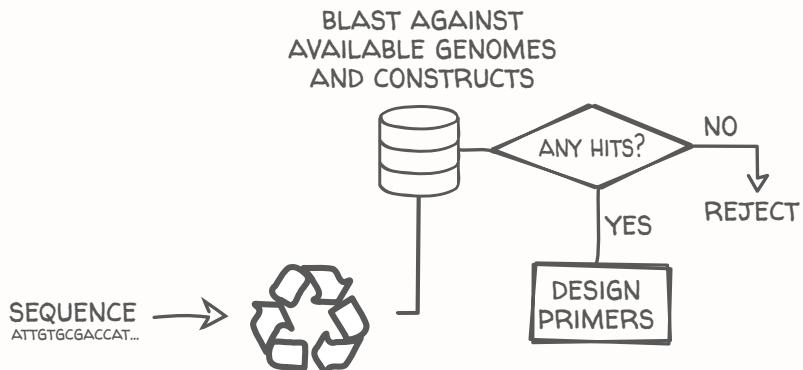


Types of DNA sources supported in DNA Weaver



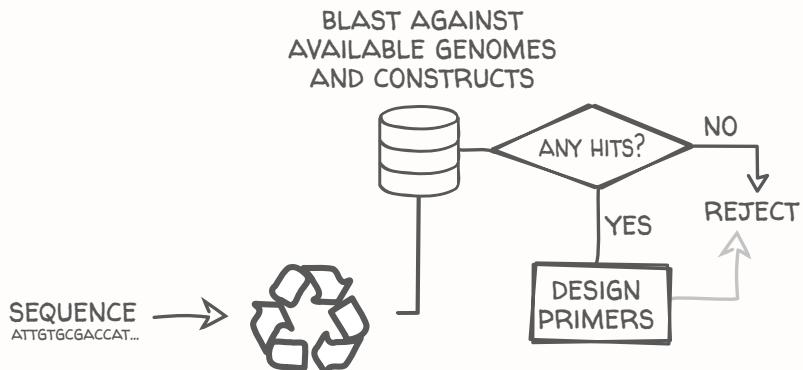
Types of DNA sources supported in DNA Weaver

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- COMPARATOR
- DNA ASSEMBLY
- ADAPTER
- PCR LINEARISATION



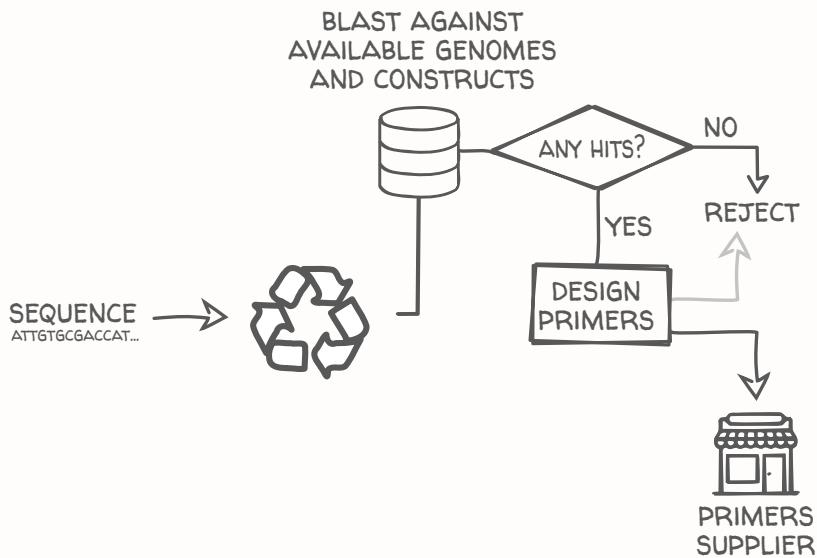
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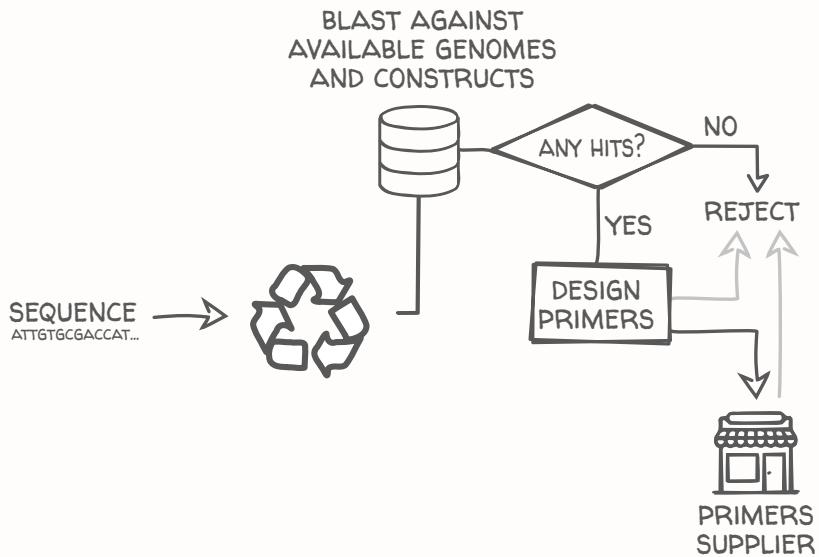
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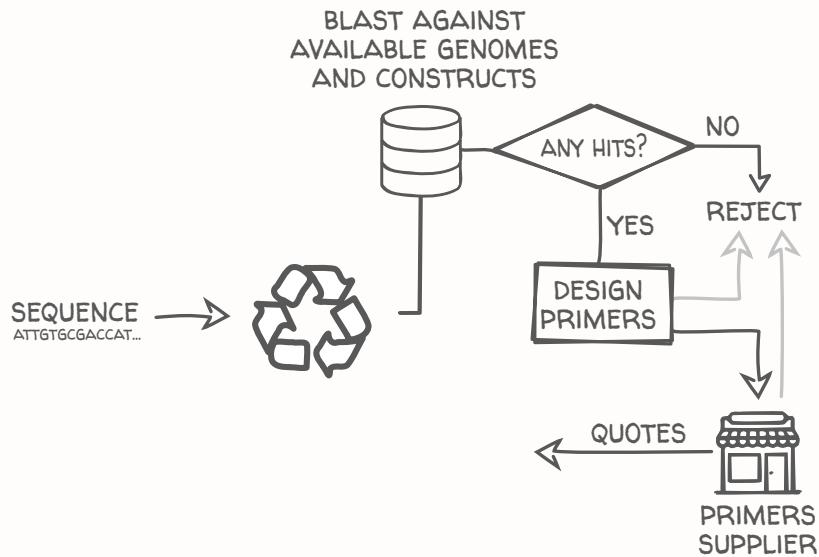
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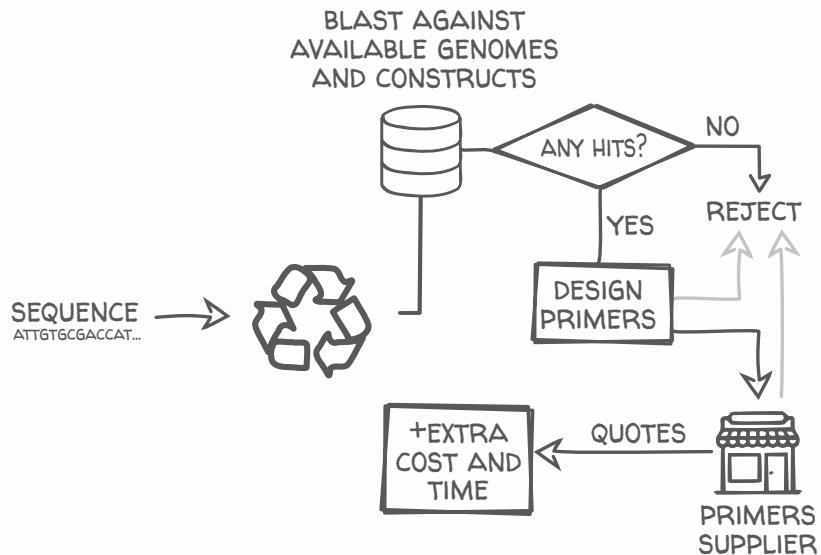
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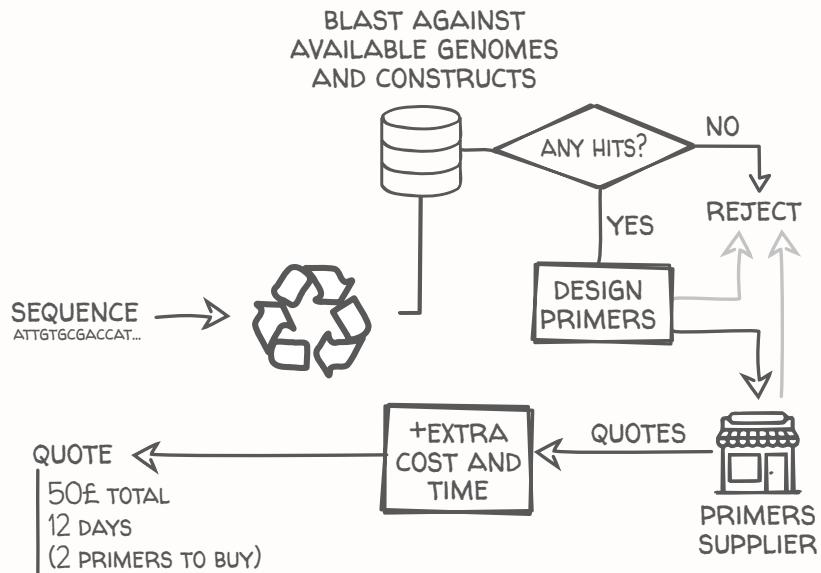
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Types of DNA sources supported in DNA Weaver

- DNA VENDOR
- PARTS LIBRARY
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- COMPARATOR
- DNA ASSEMBLY
- ADAPTER
- PCR LINEARISATION



Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



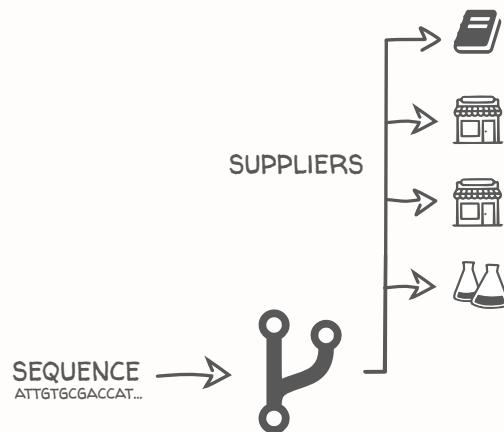
PCR LINEARISATION

Types of DNA sources supported in DNA Weaver

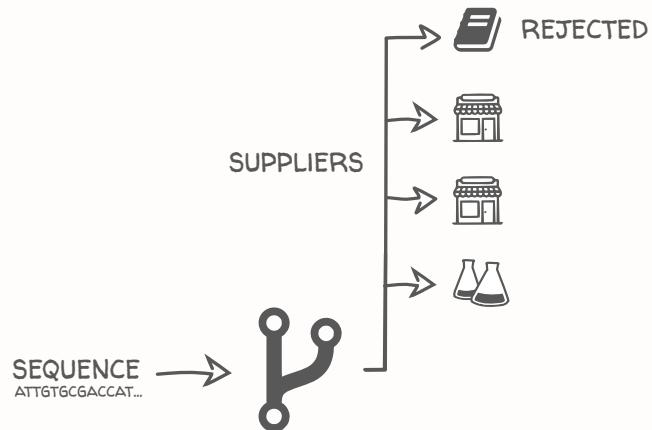
-  DNA VENDOR
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-  PCR EXTRACTION
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Types of DNA sources supported in DNA Weaver

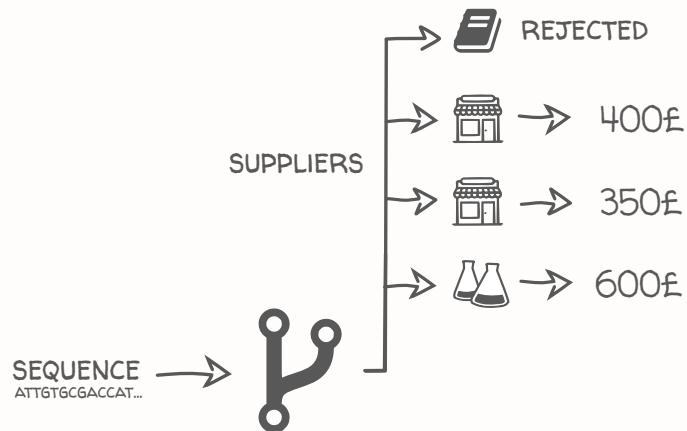


Types of DNA sources supported in DNA Weaver



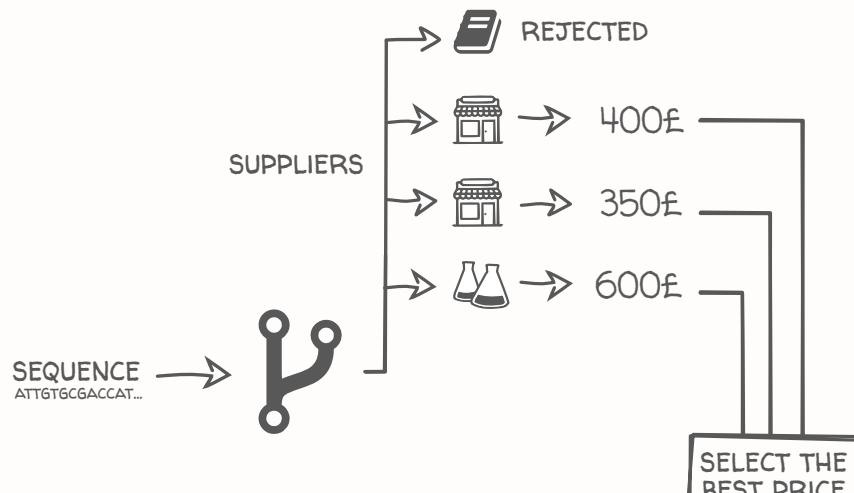
Types of DNA sources supported in DNA Weaver

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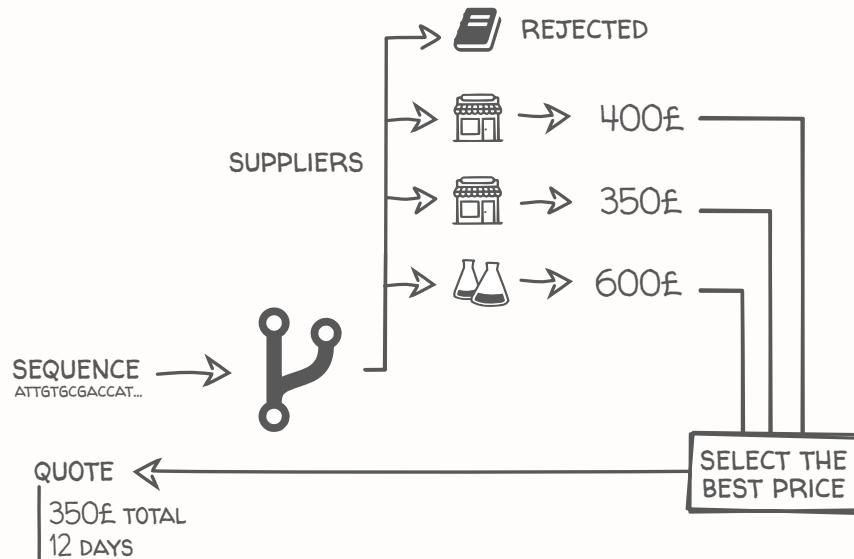
Types of DNA sources supported in DNA Weaver

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Types of DNA sources supported in DNA Weaver

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- ADAPTER
- PCR LINEARISATION



Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION

Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER

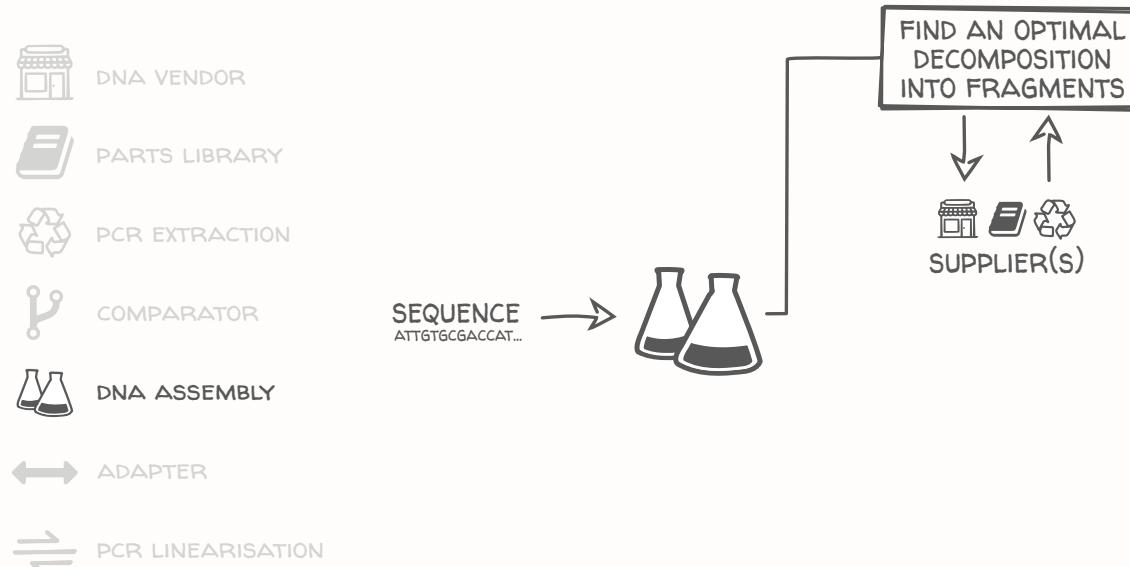


PCR LINEARISATION

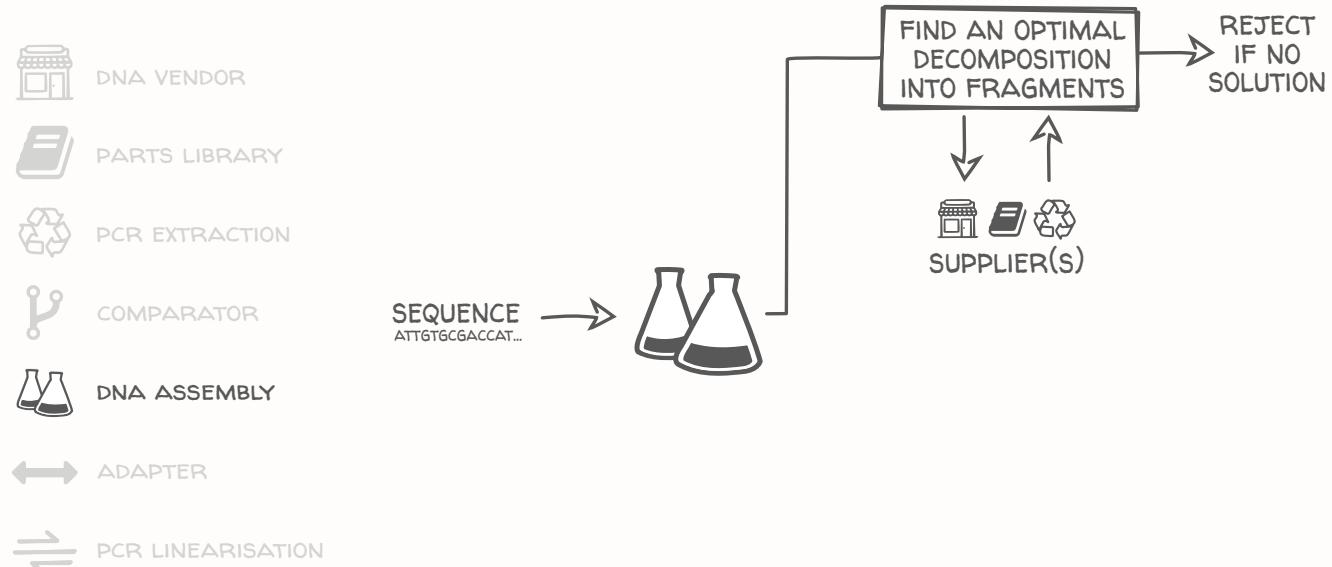
SEQUENCE
ATTGTGCGACCAT...



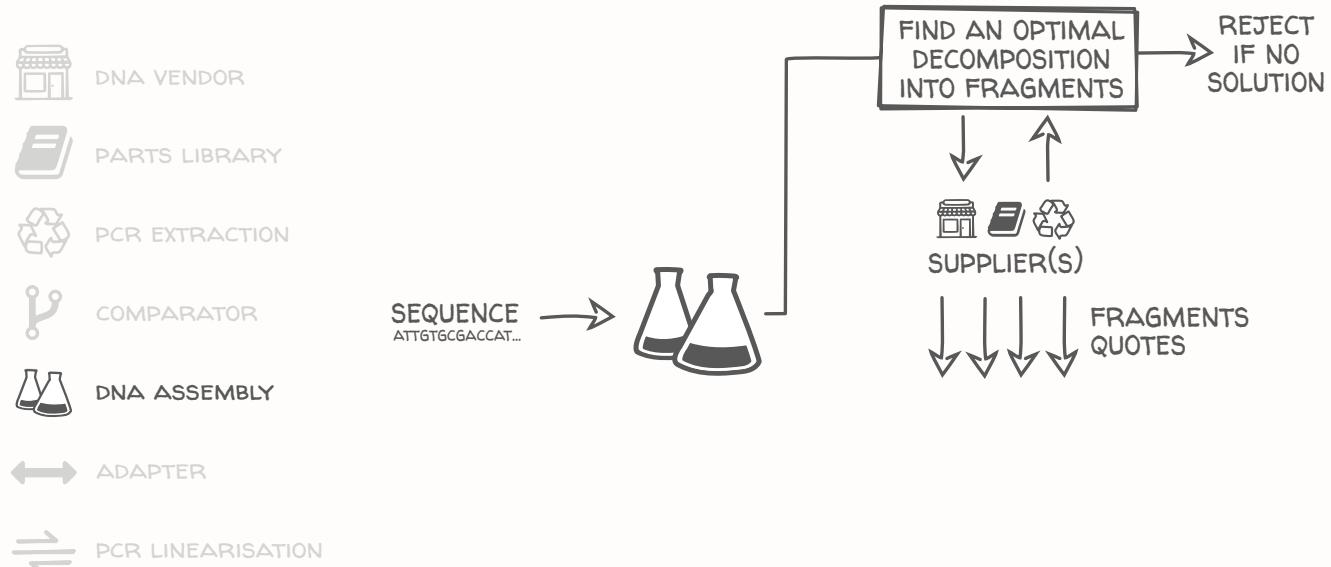
Types of DNA sources supported in DNA Weaver



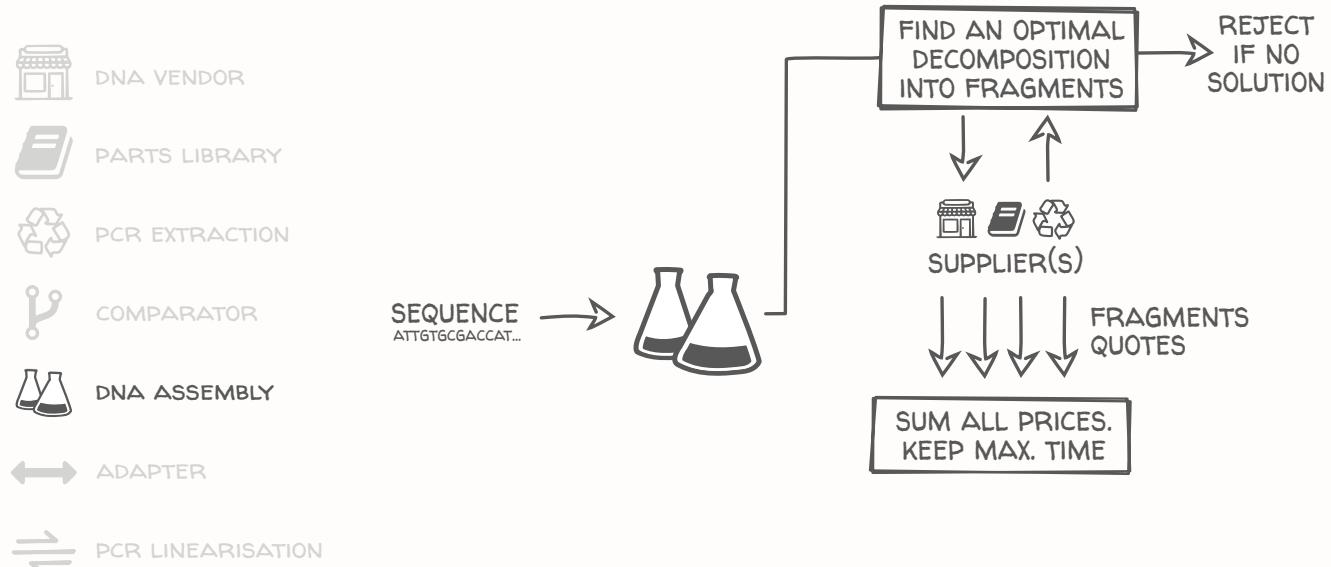
Types of DNA sources supported in DNA Weaver



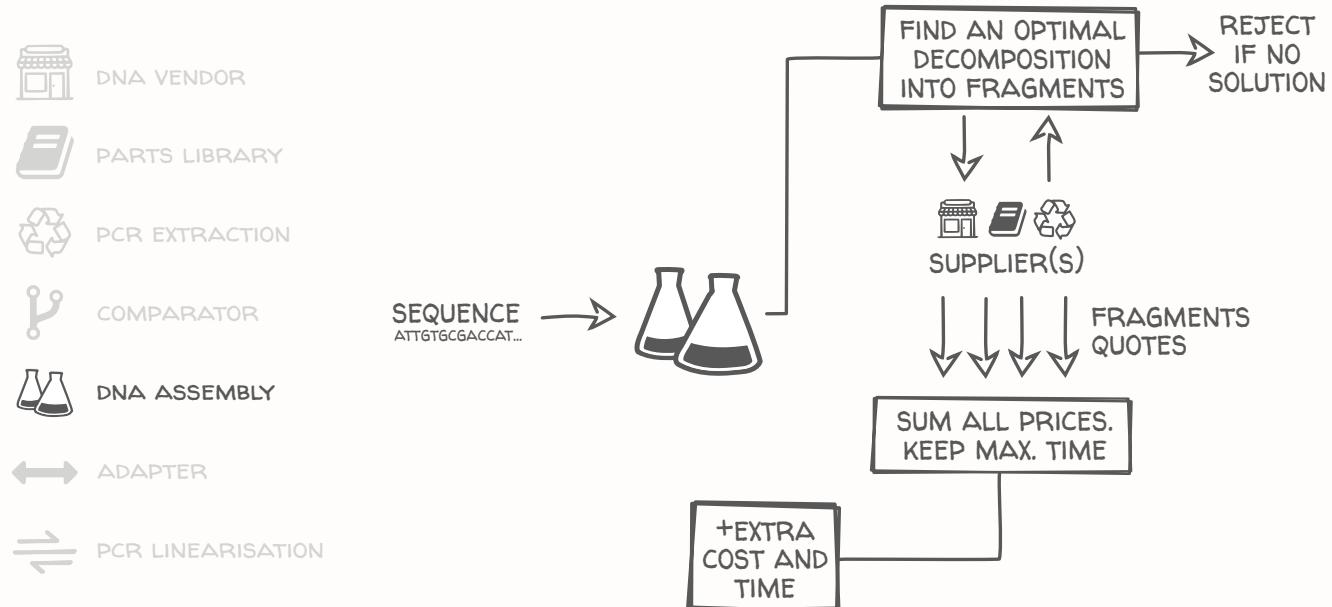
Types of DNA sources supported in DNA Weaver



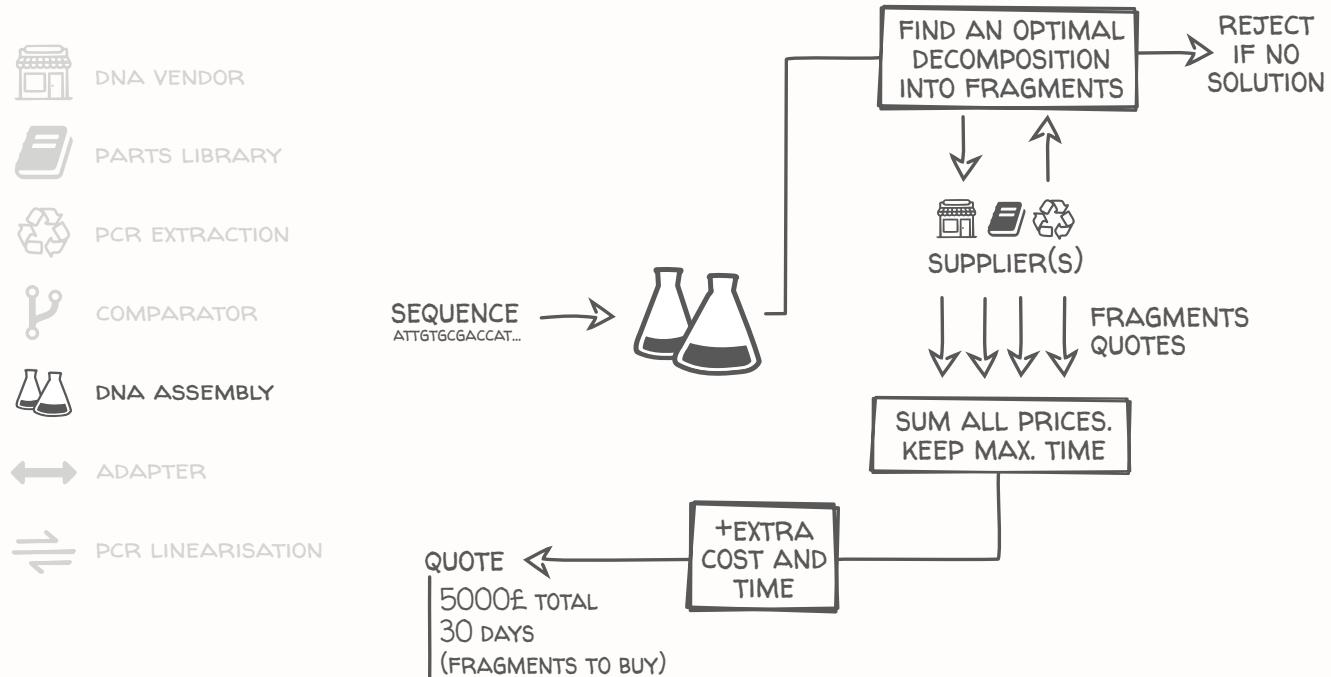
Types of DNA sources supported in DNA Weaver



Types of DNA sources supported in DNA Weaver



Types of DNA sources supported in DNA Weaver



Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION

Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



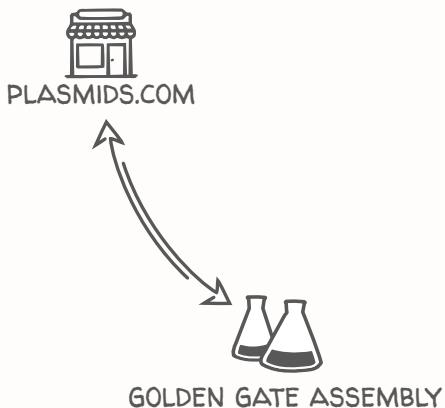
PCR LINEARISATION



GOLDEN GATE ASSEMBLY

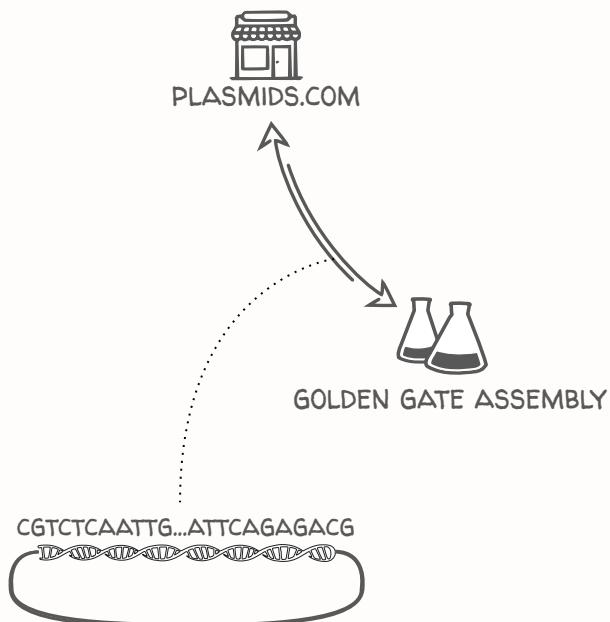
Types of DNA sources supported in DNA Weaver

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-  PARTS LIBRARY
-  PCR EXTRACTION
-  COMPARATOR
-  DNA ASSEMBLY
-  ADAPTER
-  PCR LINEARISATION



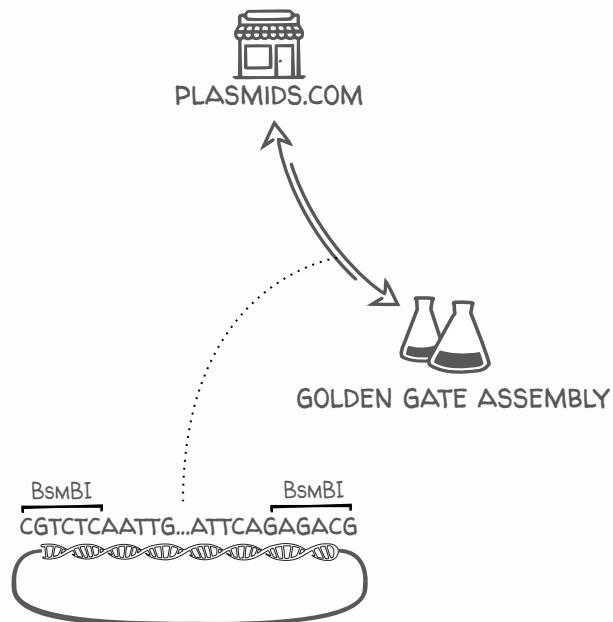
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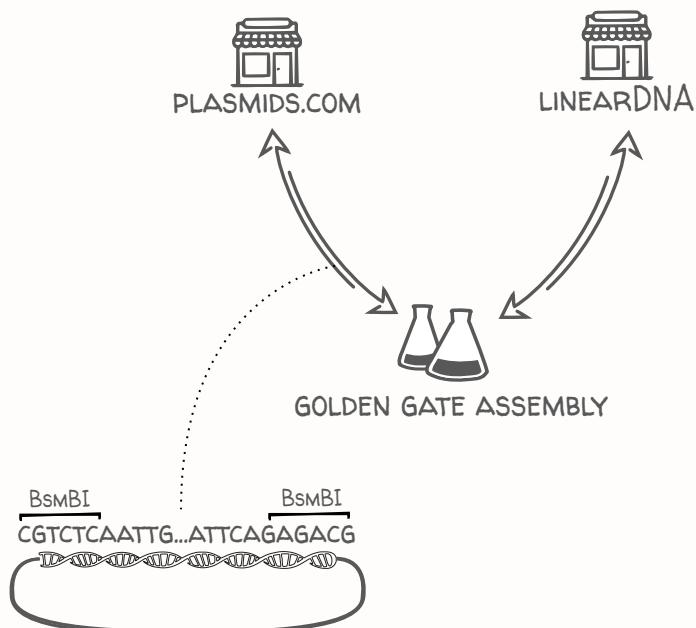
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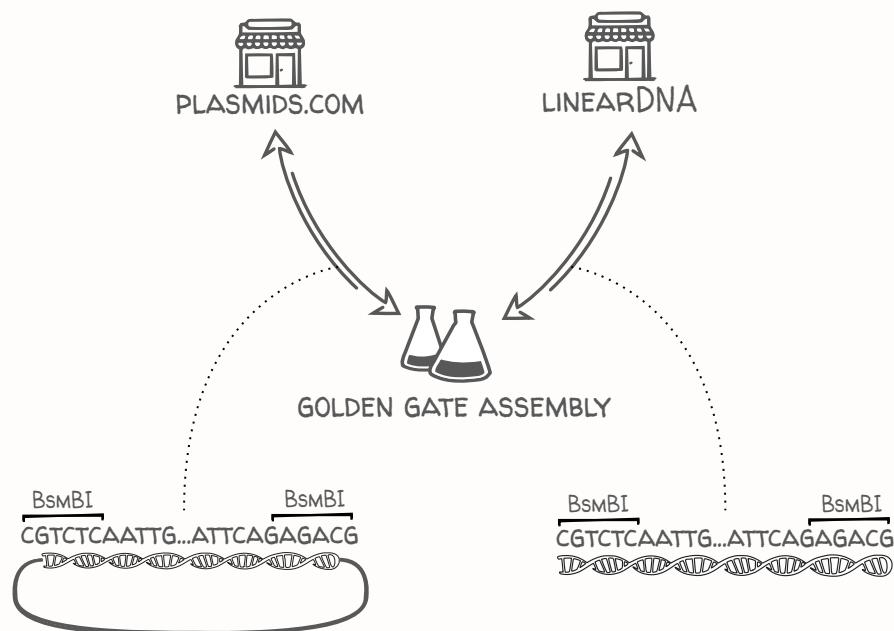
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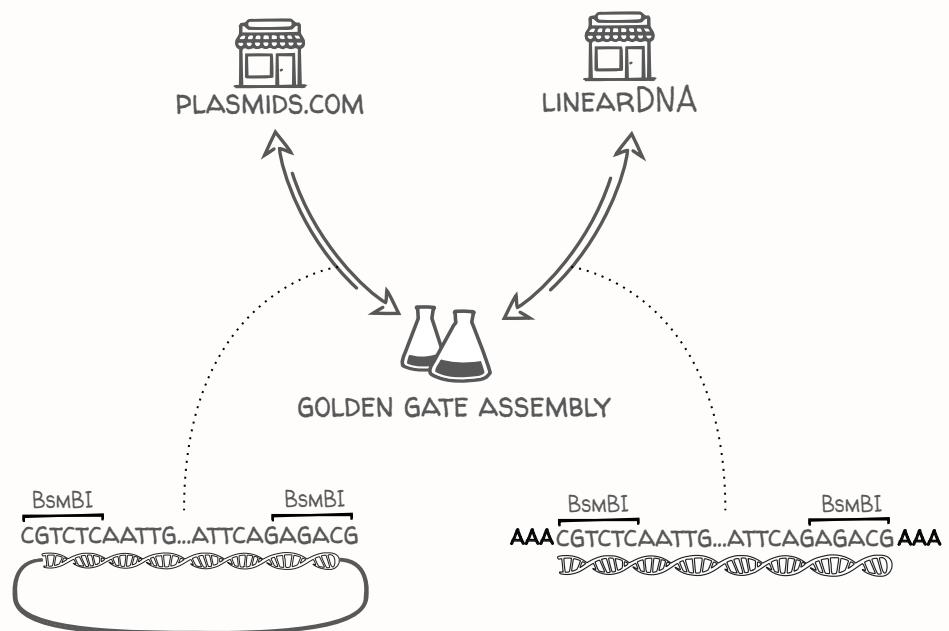
Types of DNA sources supported in DNA Weaver

- DNA VENDOR
- PARTS LIBRARY
- PCR EXTRACTION
- COMPARATOR
- DNA ASSEMBLY
- ↔ ADAPTER
- ↔ PCR LINEARISATION



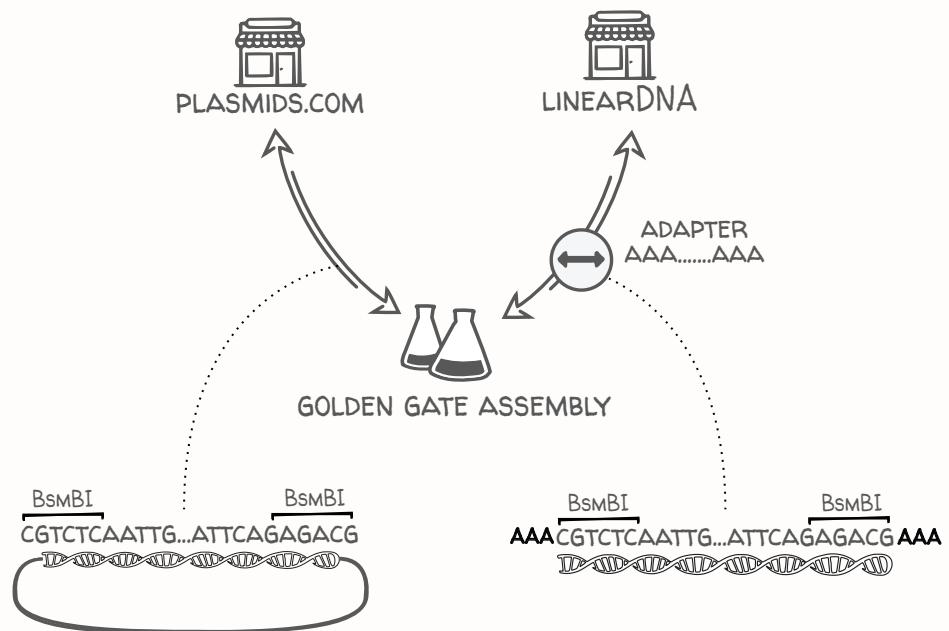
Types of DNA sources supported in DNA Weaver

- DNA VENDOR
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- PCR EXTRACTION
- COMPARATOR
- DNA ASSEMBLY
- ↔ ADAPTER
- ↔ PCR LINEARISATION



Types of DNA sources supported in DNA Weaver

- DNA VENDOR
- PARTS LIBRARY
- PCR EXTRACTION
- COMPARATOR
- DNA ASSEMBLY
- ↔ ADAPTER
- ↔ PCR LINEARISATION



Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



PCR LINEARISATION

Types of DNA sources supported in DNA Weaver



DNA VENDOR



PARTS LIBRARY



PCR EXTRACTION



COMPARATOR



DNA ASSEMBLY



ADAPTER



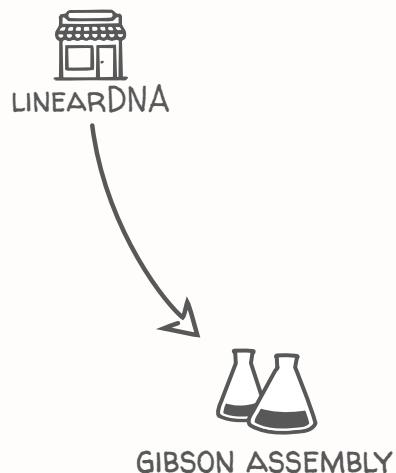
PCR LINEARISATION



GIBSON ASSEMBLY

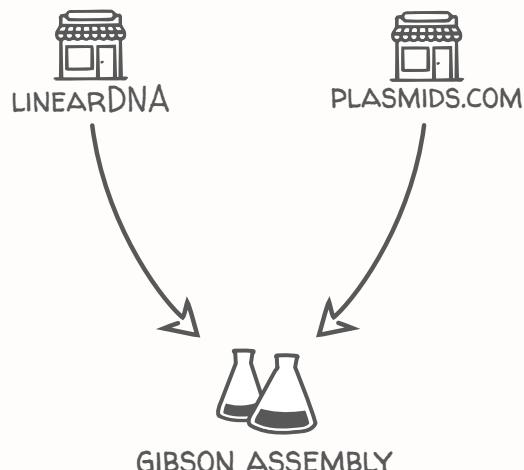
Types of DNA sources supported in DNA Weaver

- DNA VENDOR
- PARTS LIBRARY
- PCR EXTRACTION
- COMPARATOR
- DNA ASSEMBLY
- ADAPTER
- PCR LINEARISATION



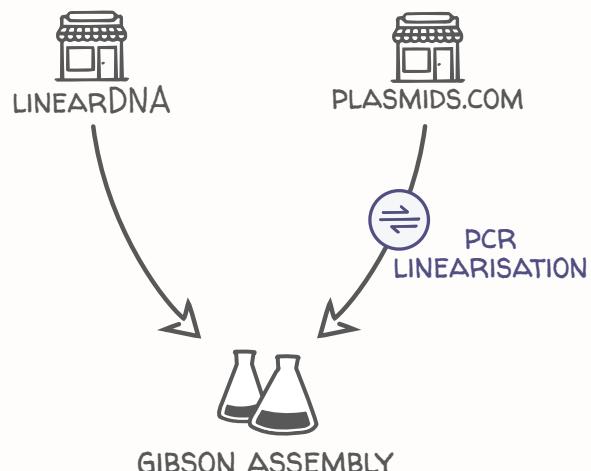
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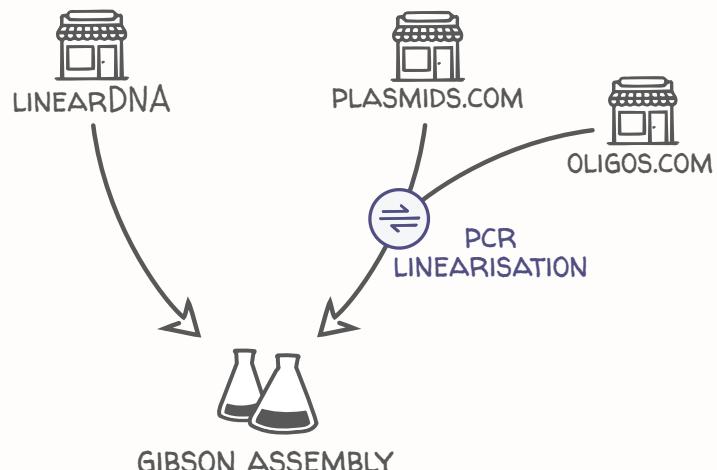
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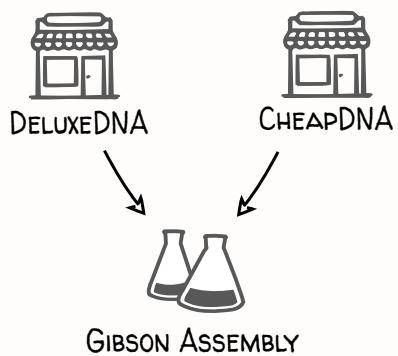
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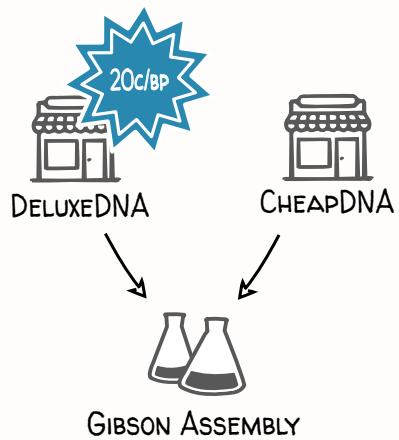


Supply networks can express many different problems

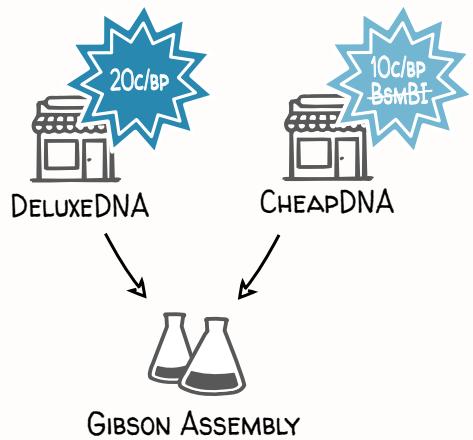
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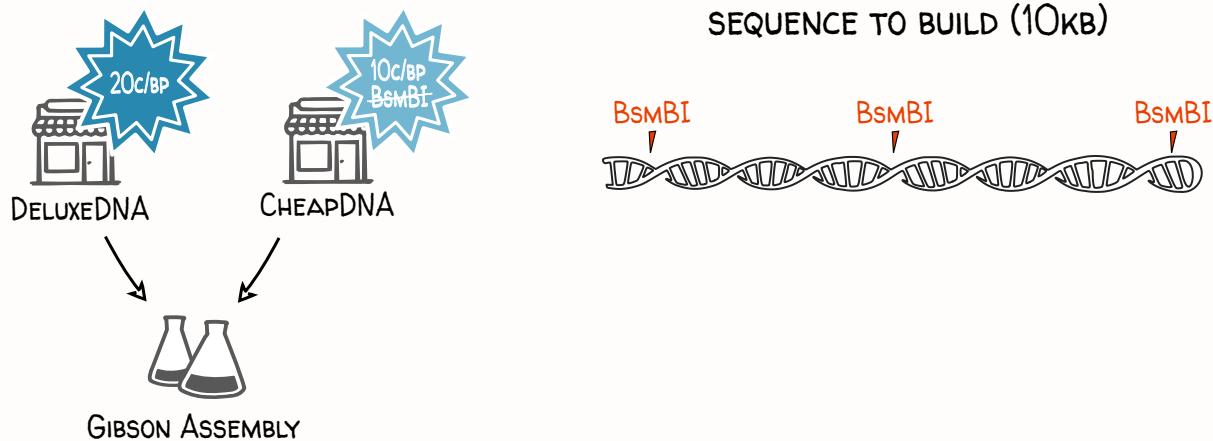
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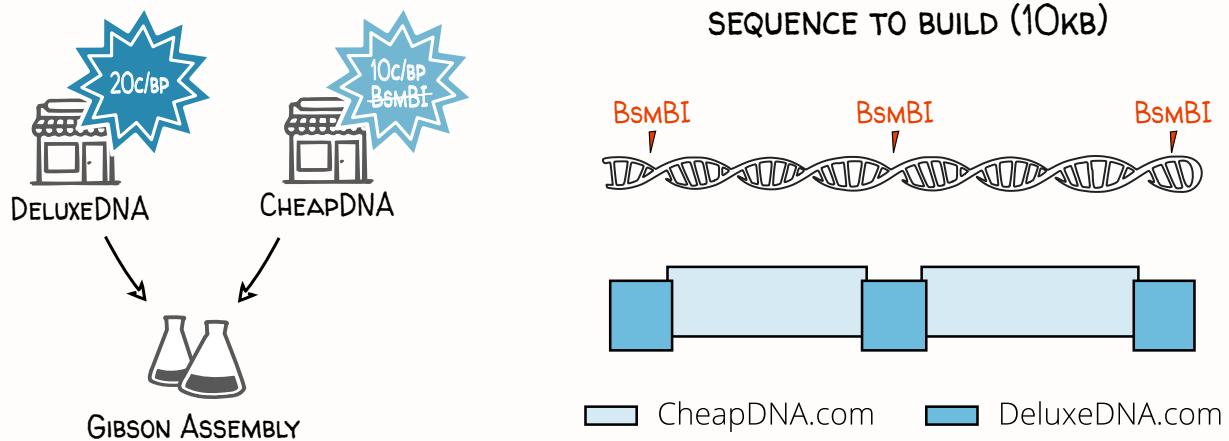
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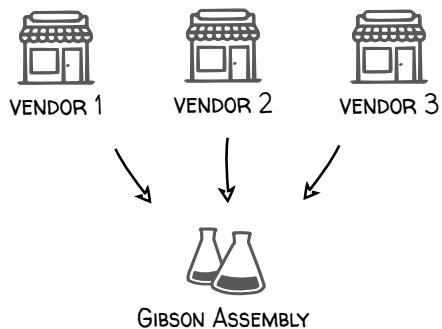


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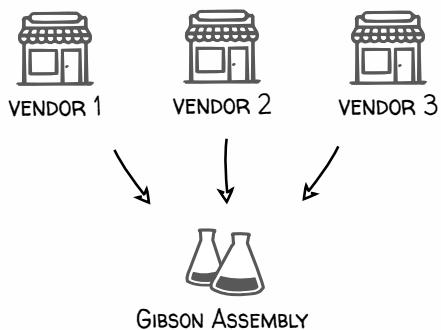
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"GET FRAGMENTS FROM
DIFFERENT COMPANIES"



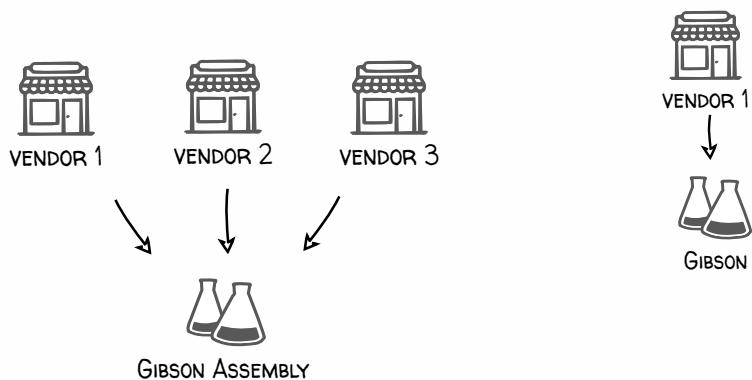
Supply networks can express many different problems

"GET FRAGMENTS FROM DIFFERENT COMPANIES" → "CHOOSE ONE COMPANY AND ORDER ALL FRAGMENTS THERE"



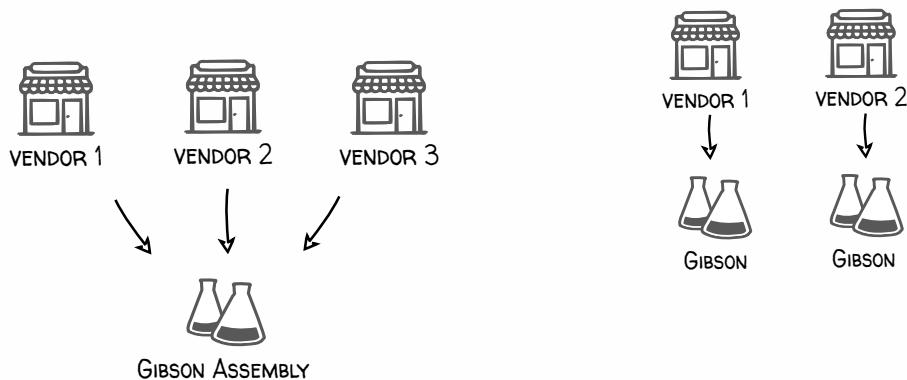
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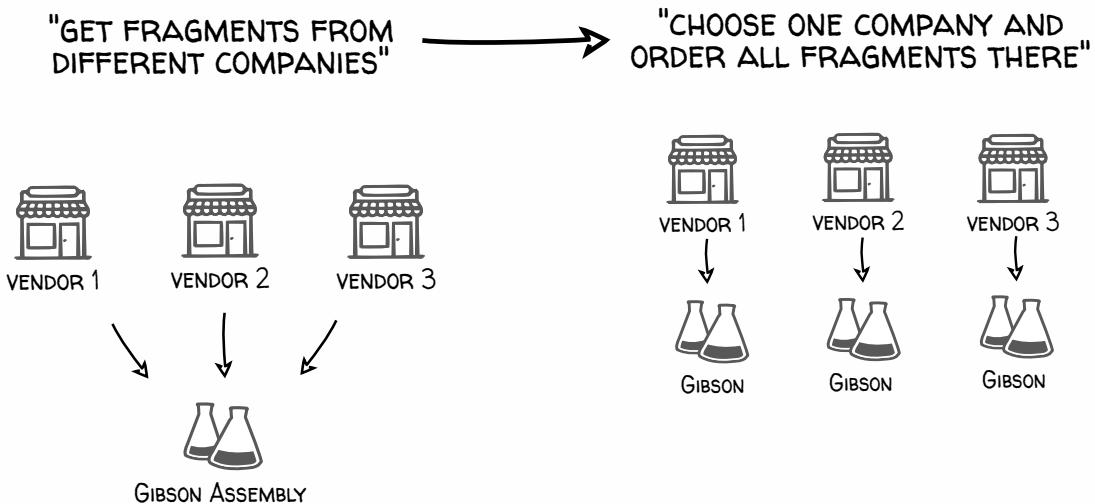


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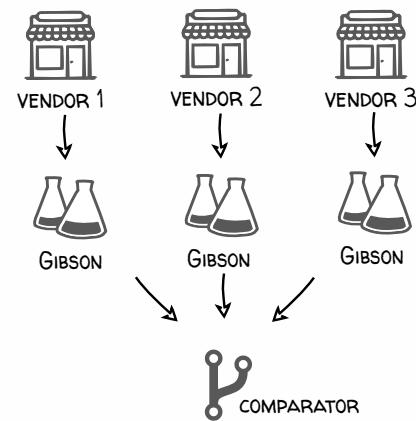
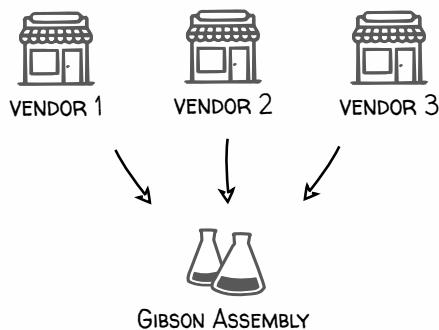


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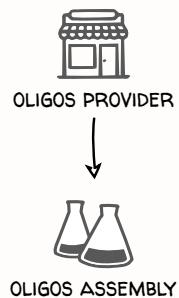
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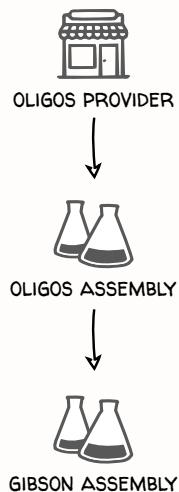


OLIGOS PROVIDER

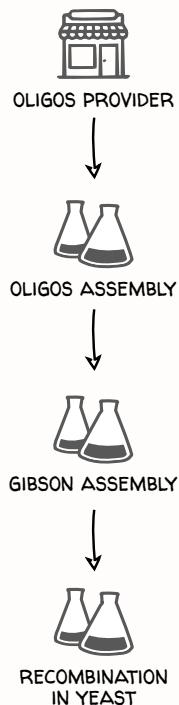
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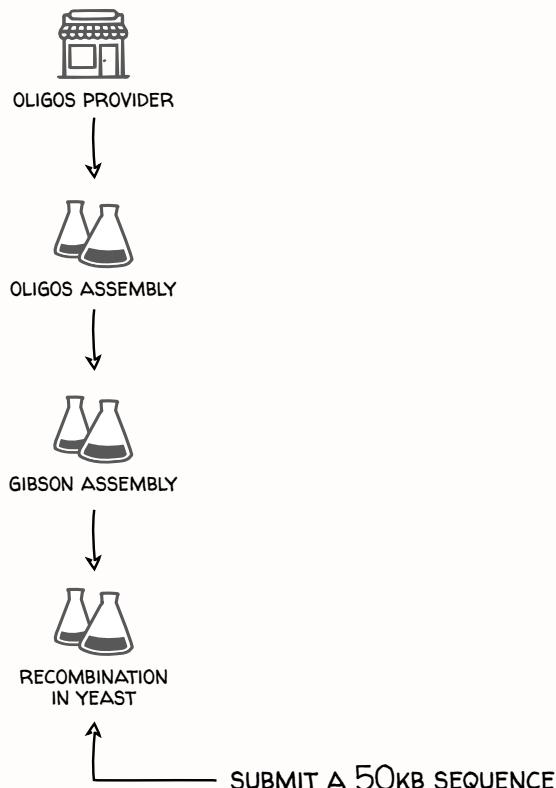
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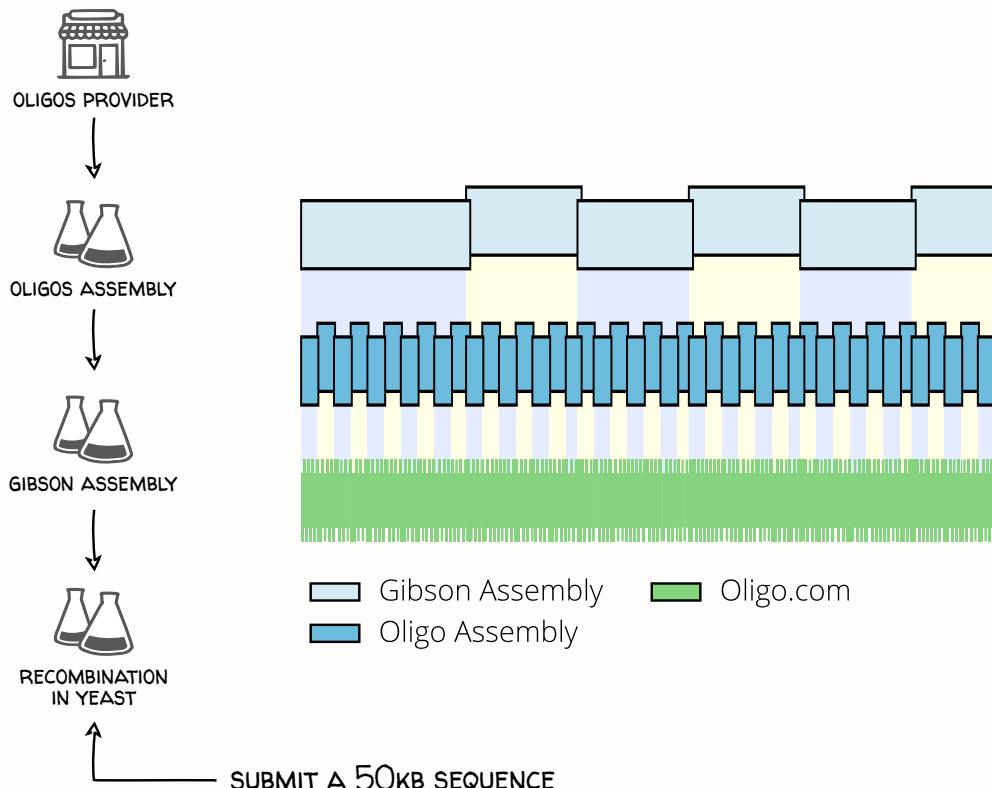
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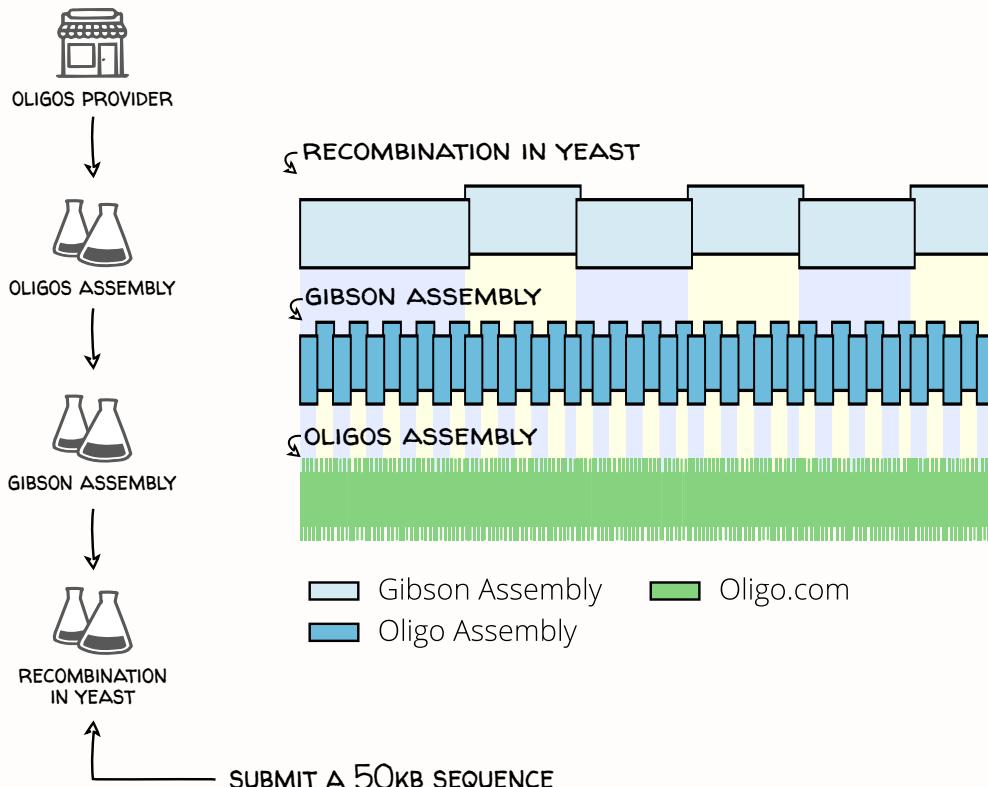
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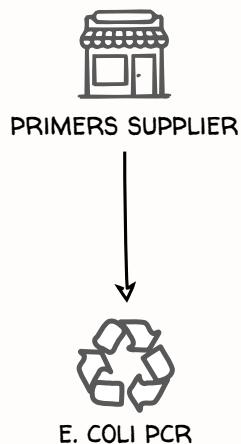
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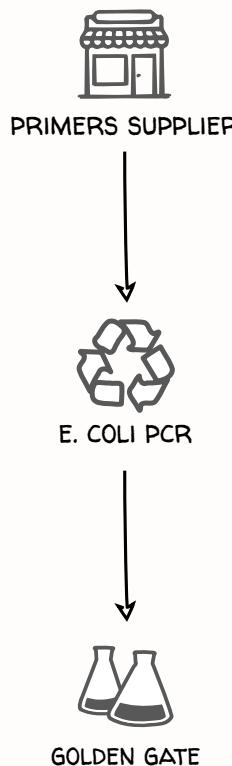


PRIMERS SUPPLIER

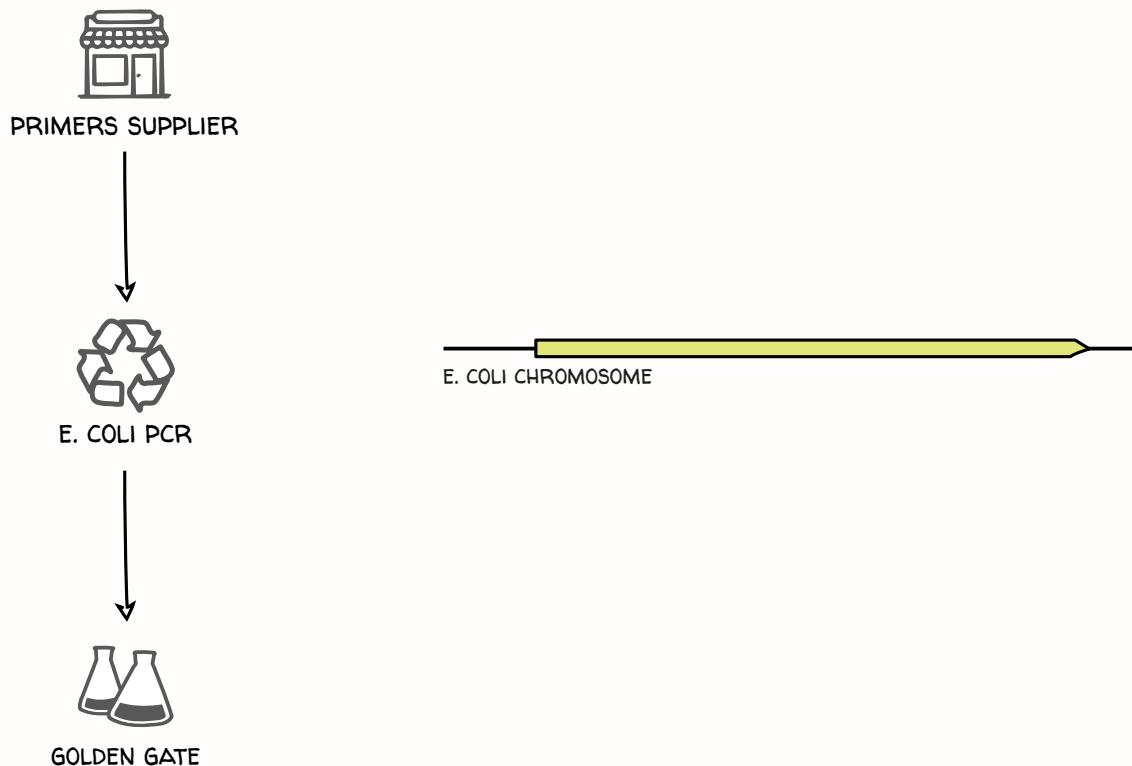
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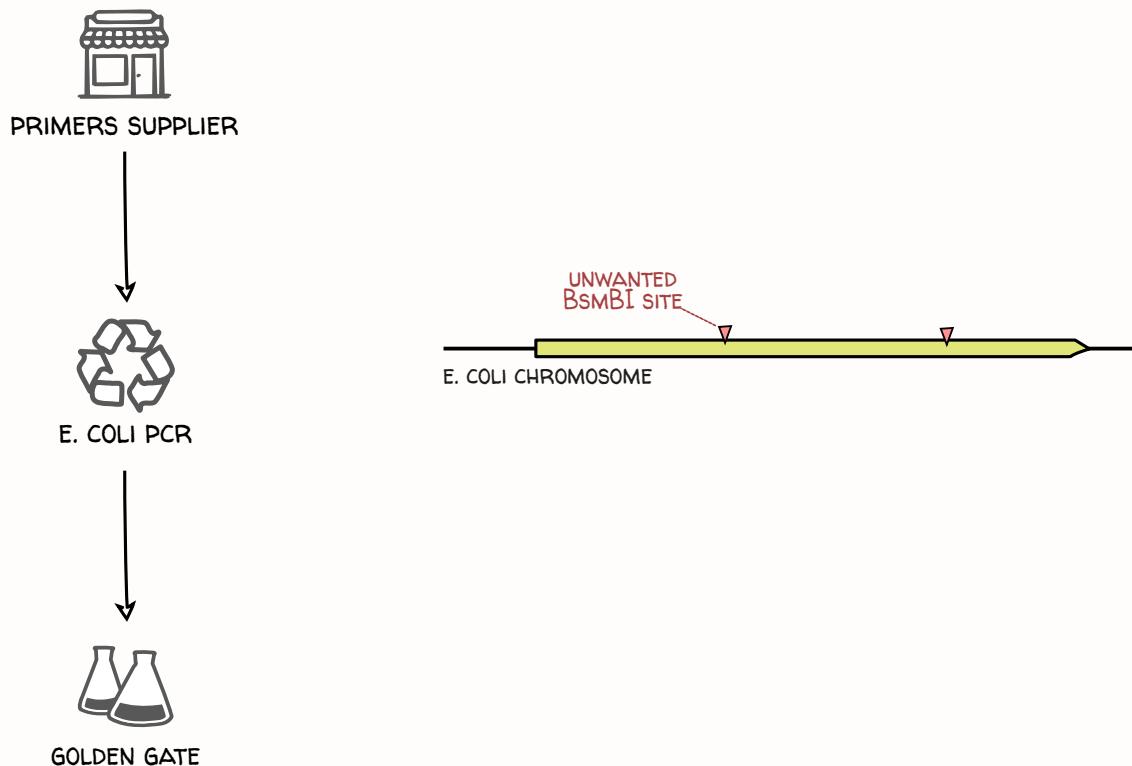
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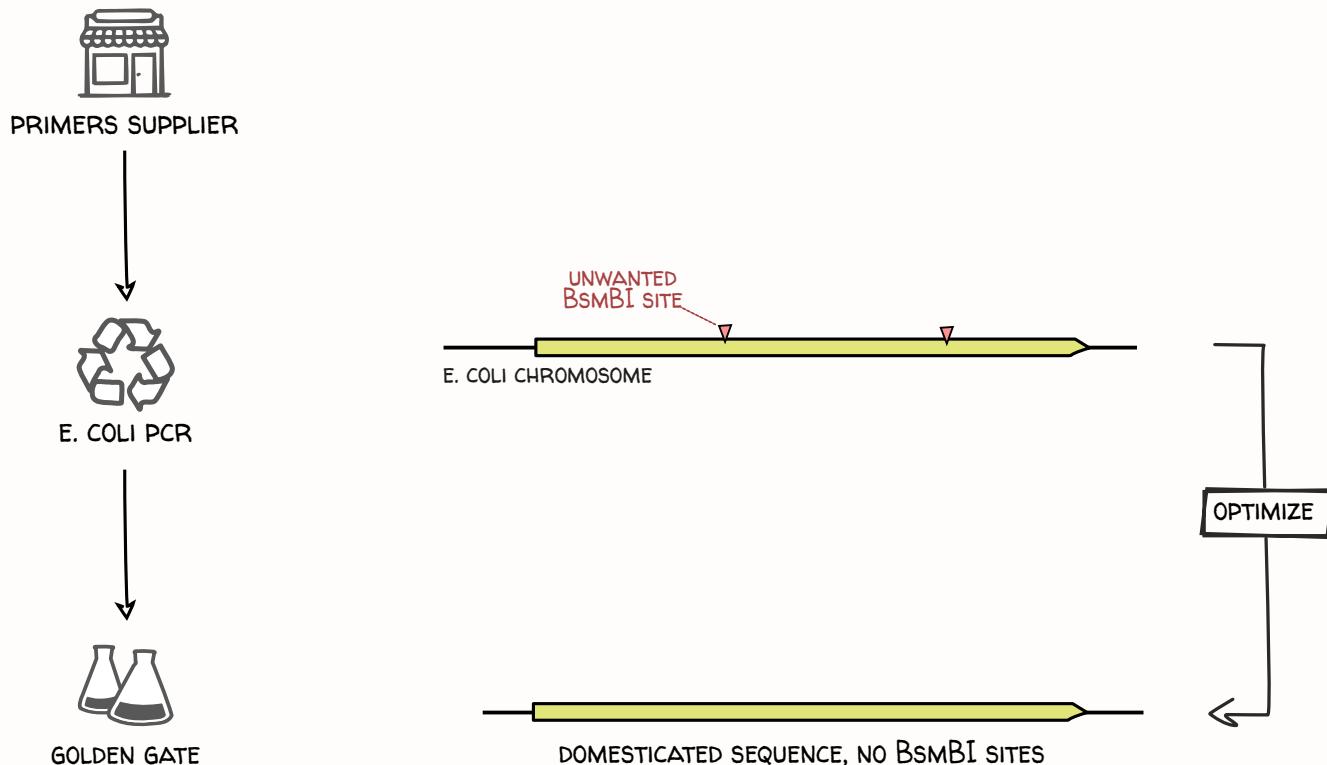
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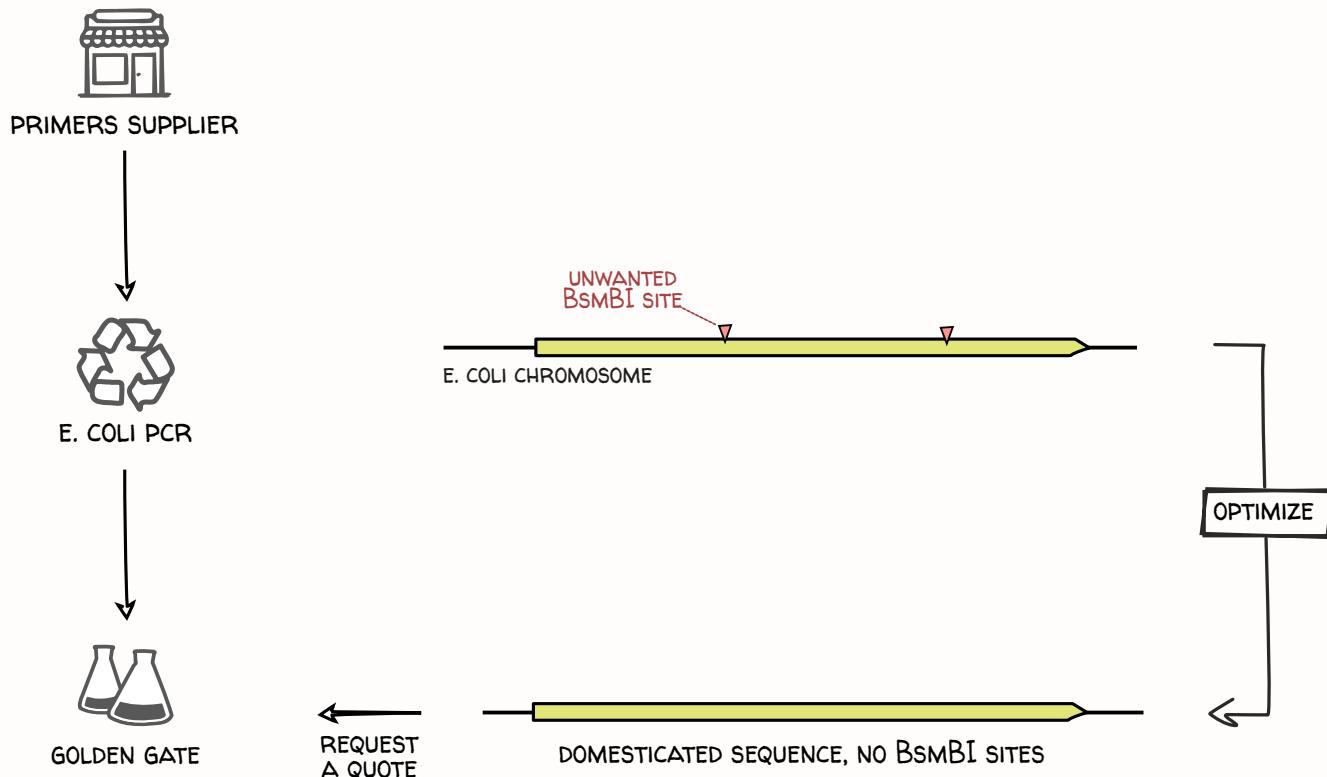
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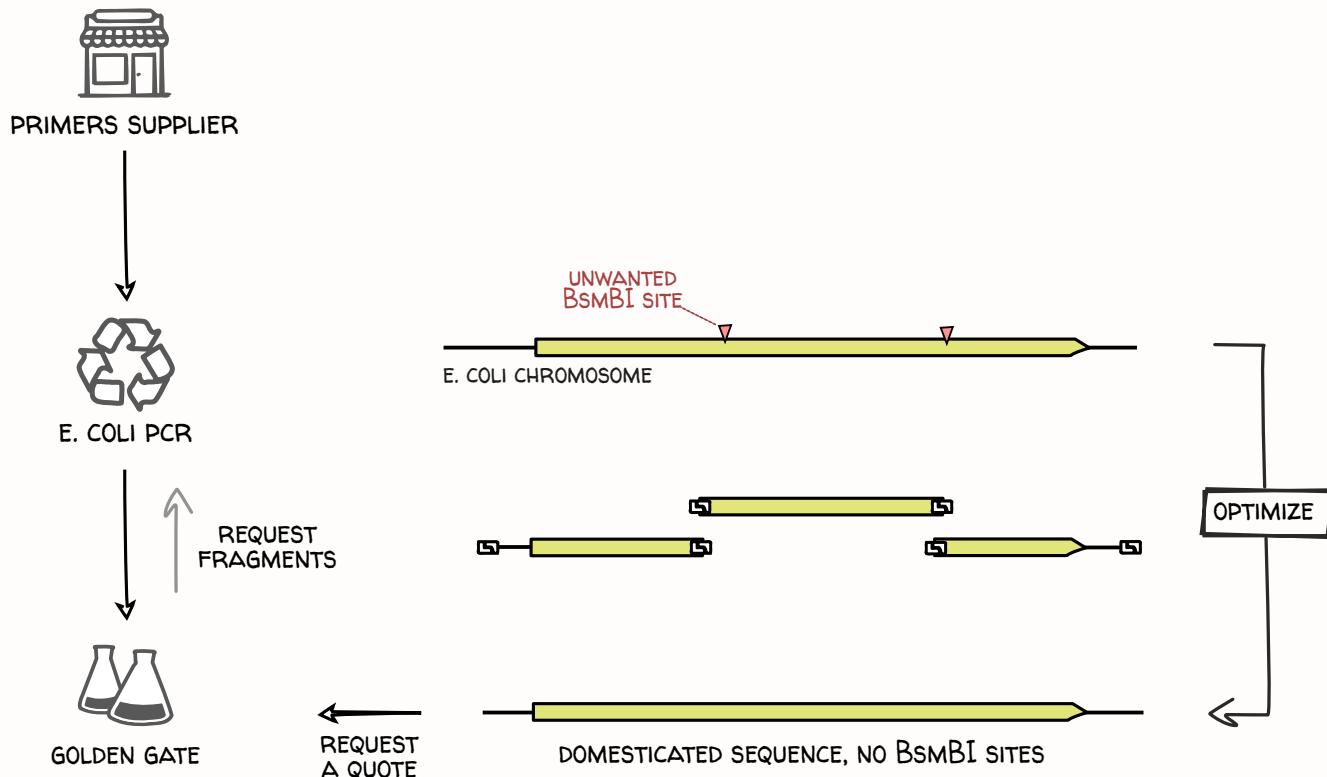
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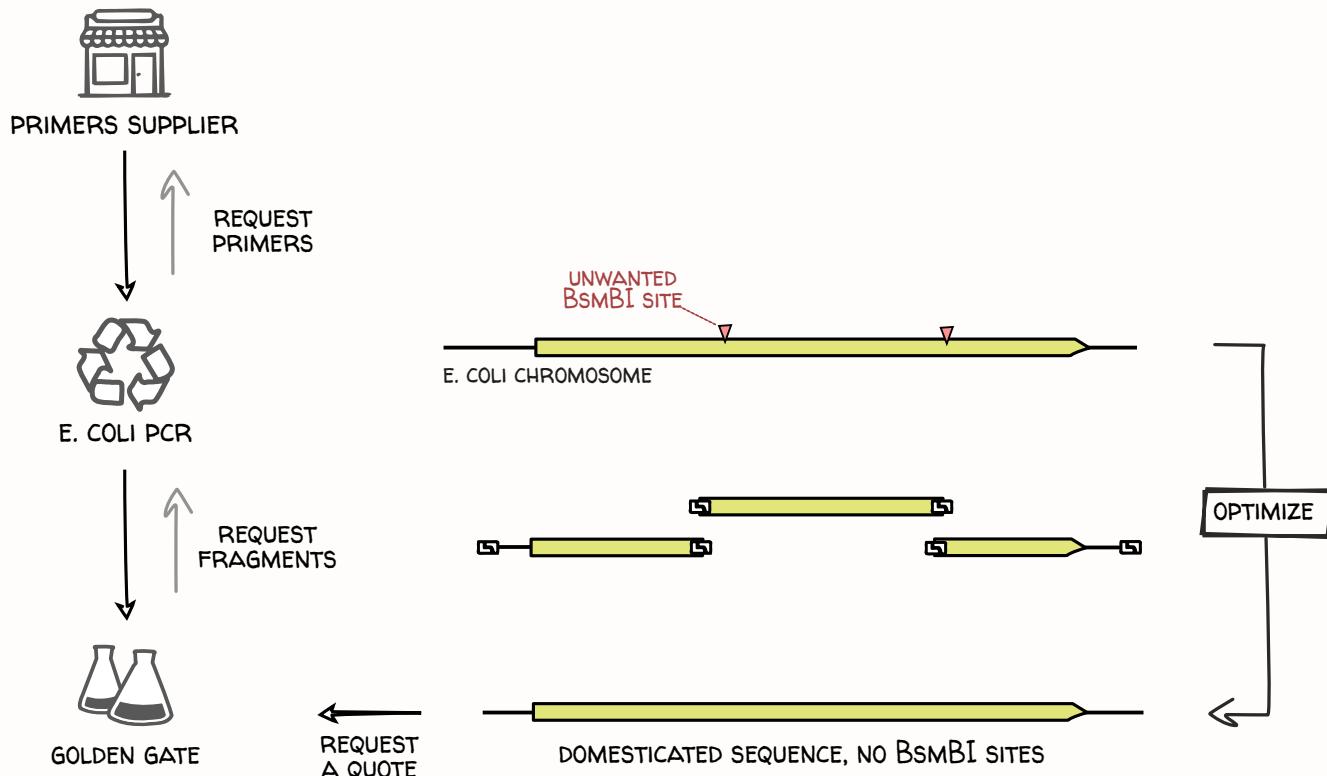
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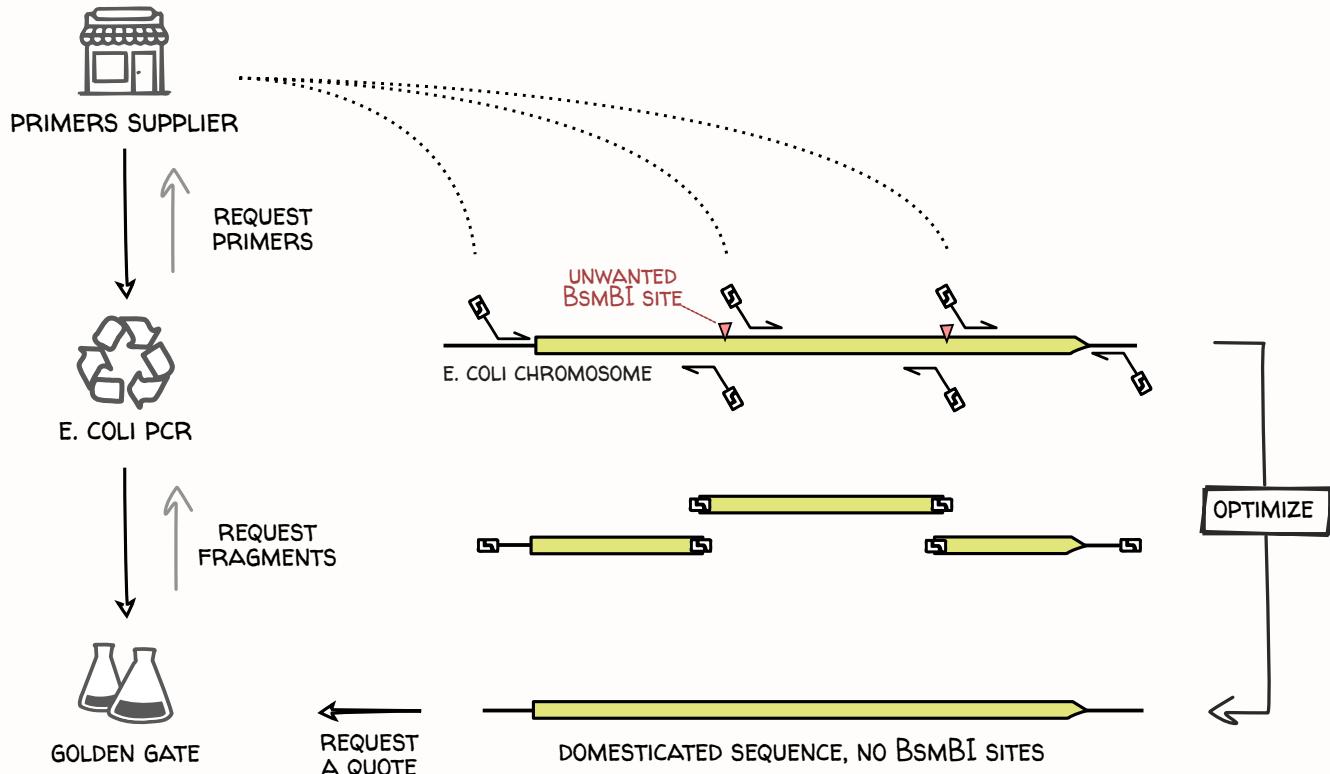
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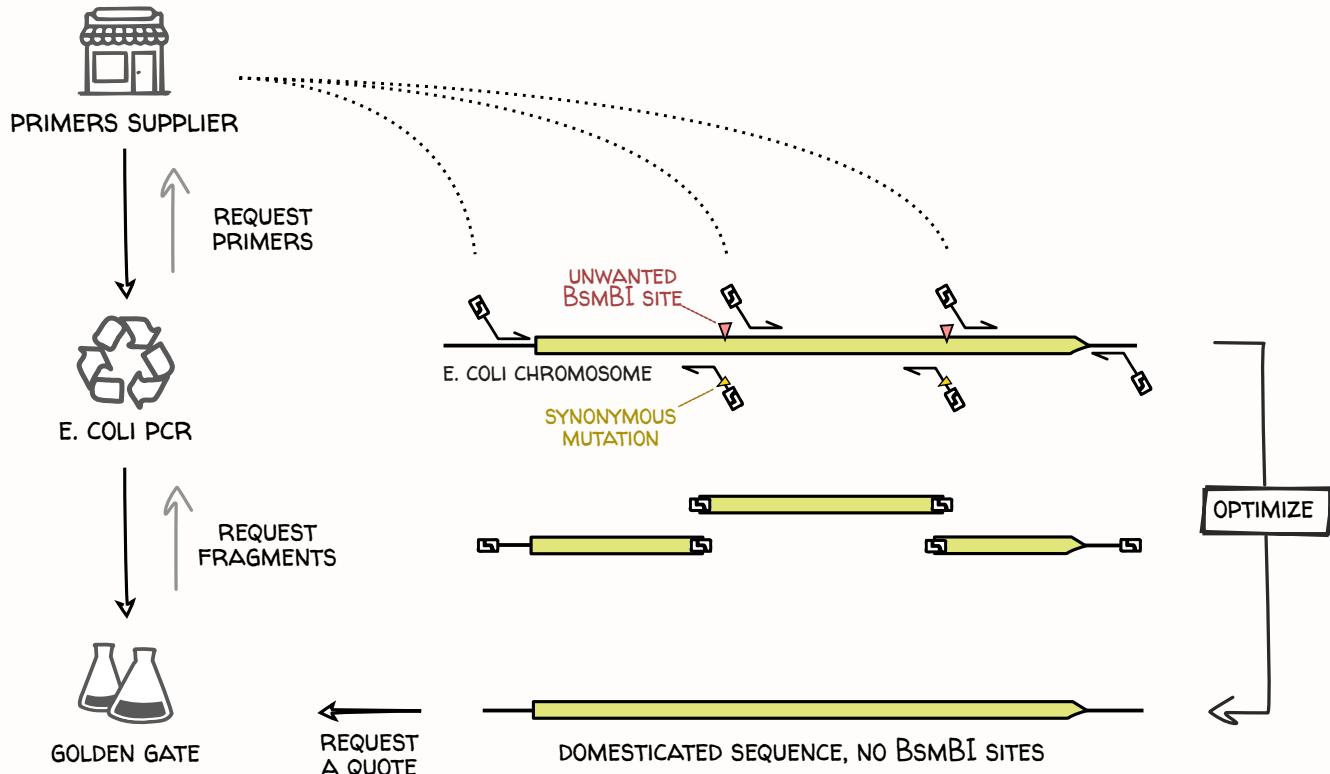
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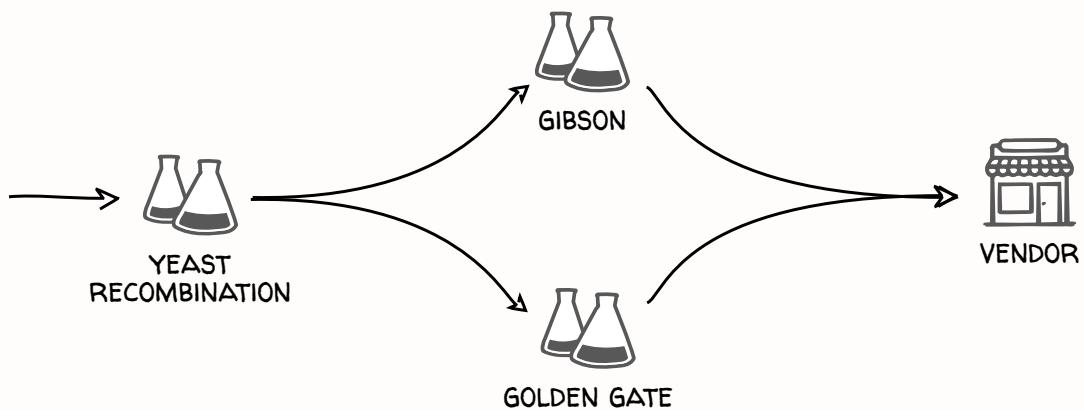


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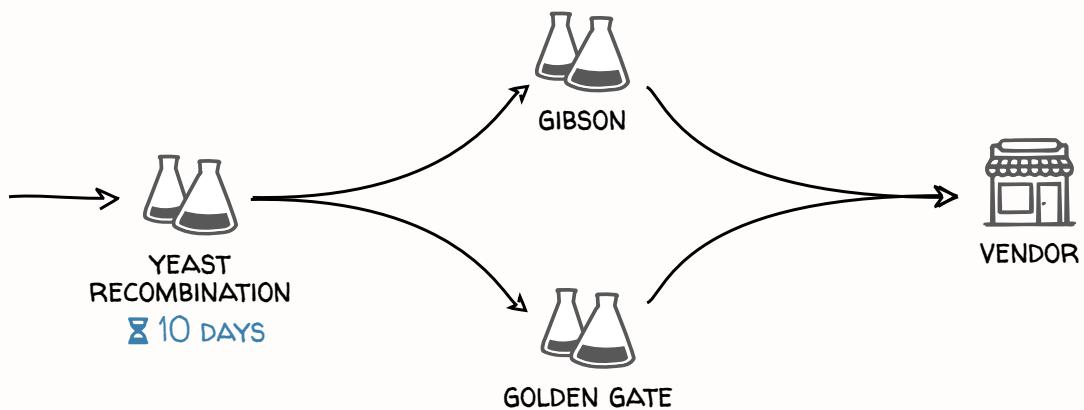


Finding the best assembly plan under a time constraint

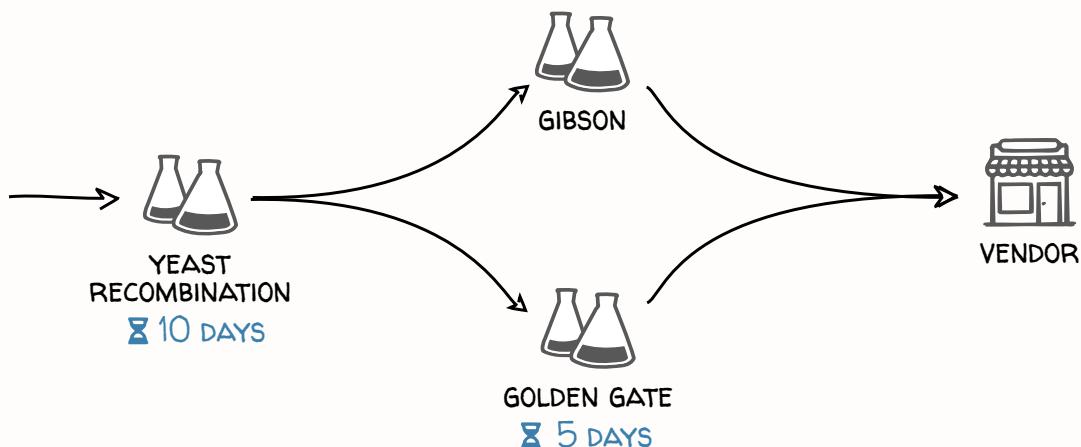
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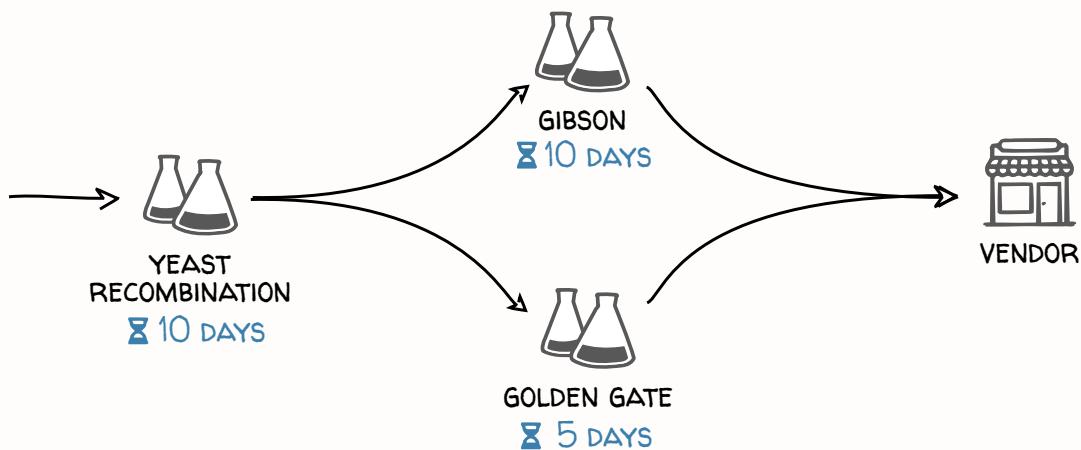
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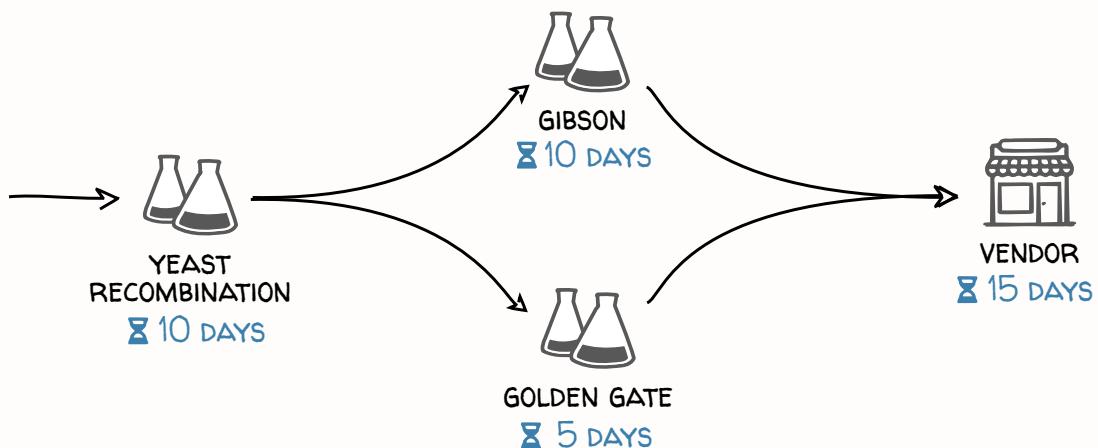
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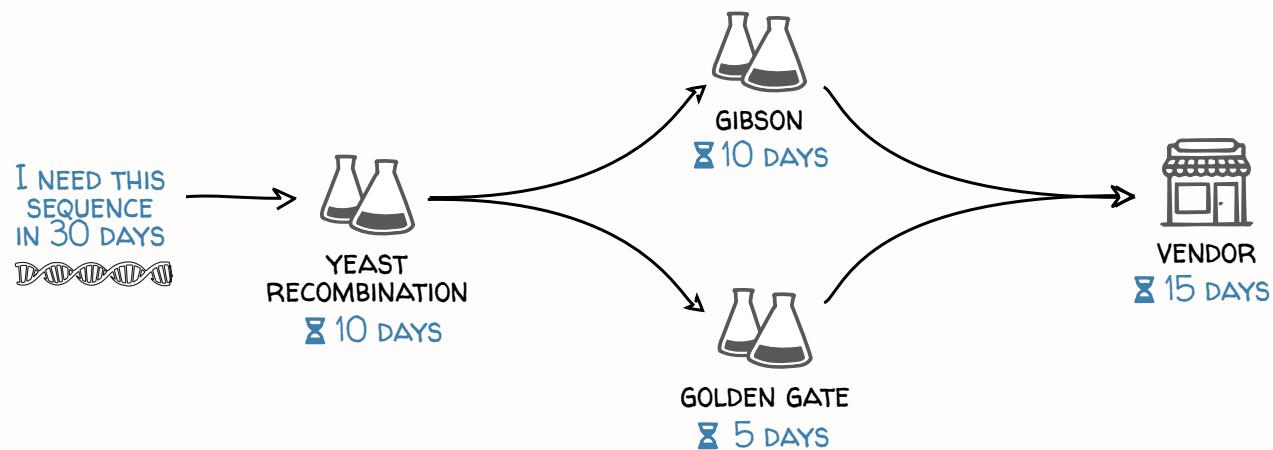
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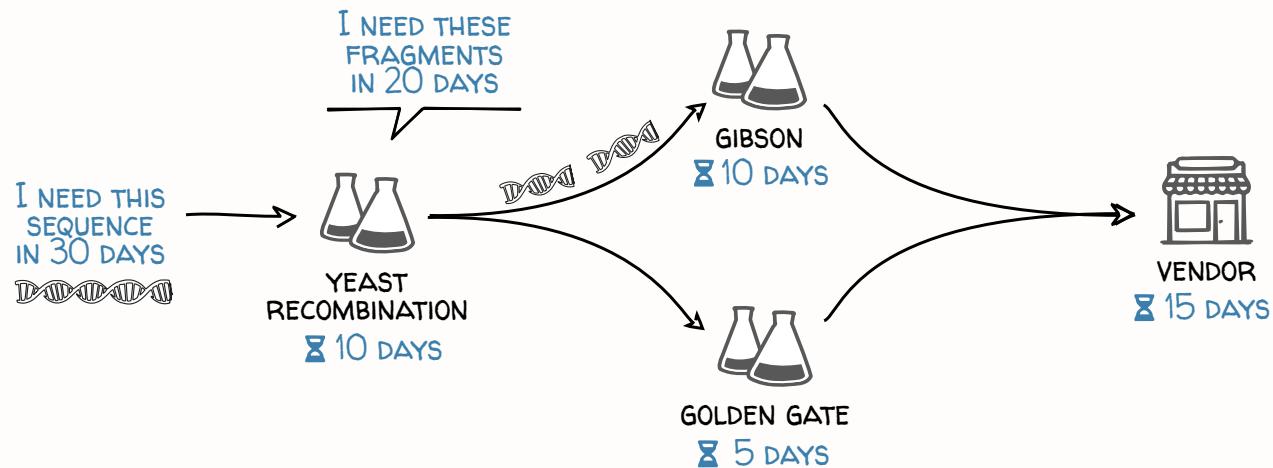
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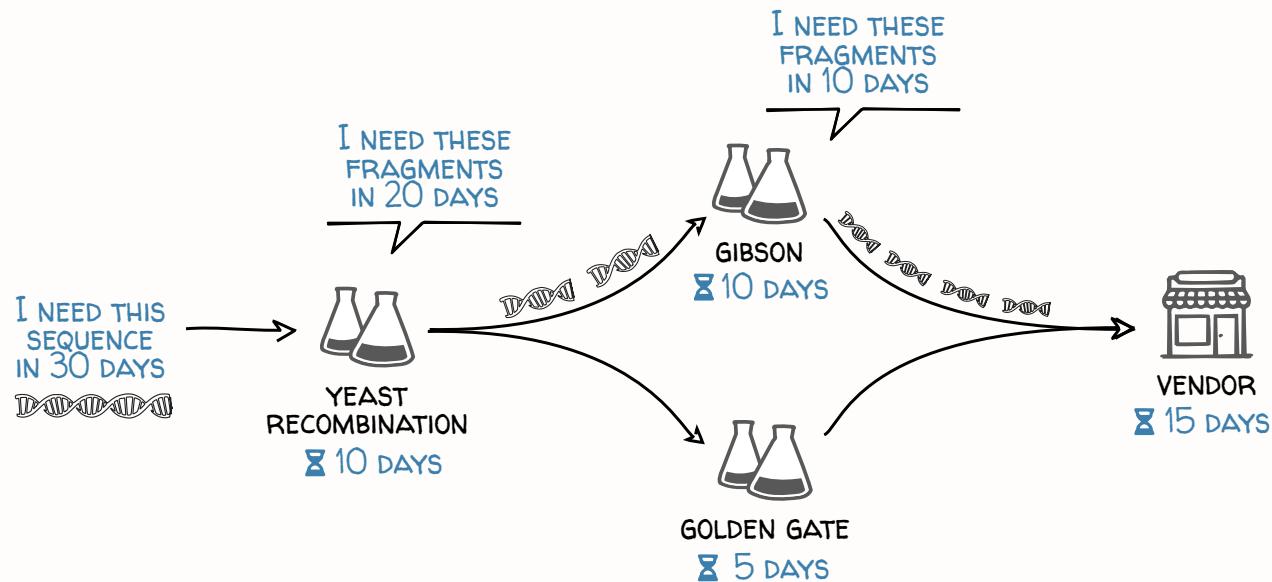
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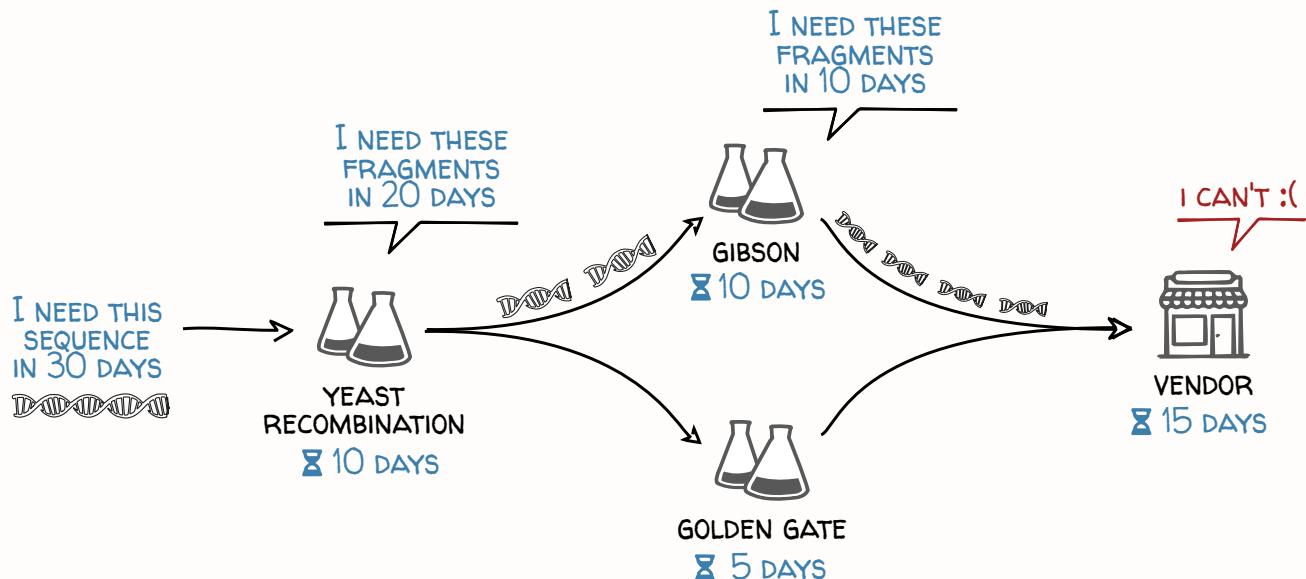
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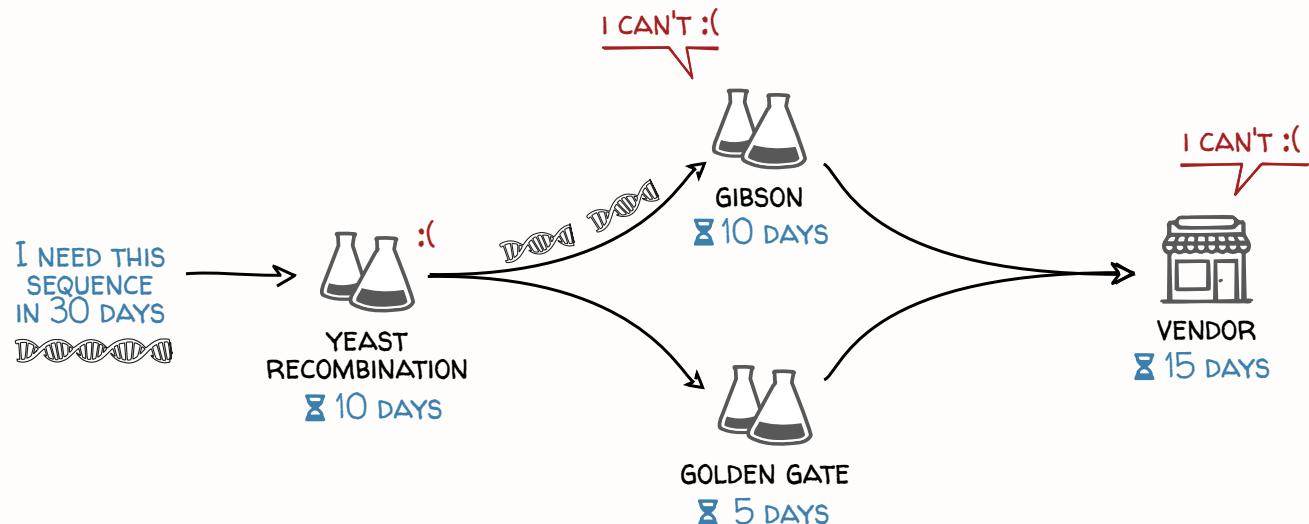
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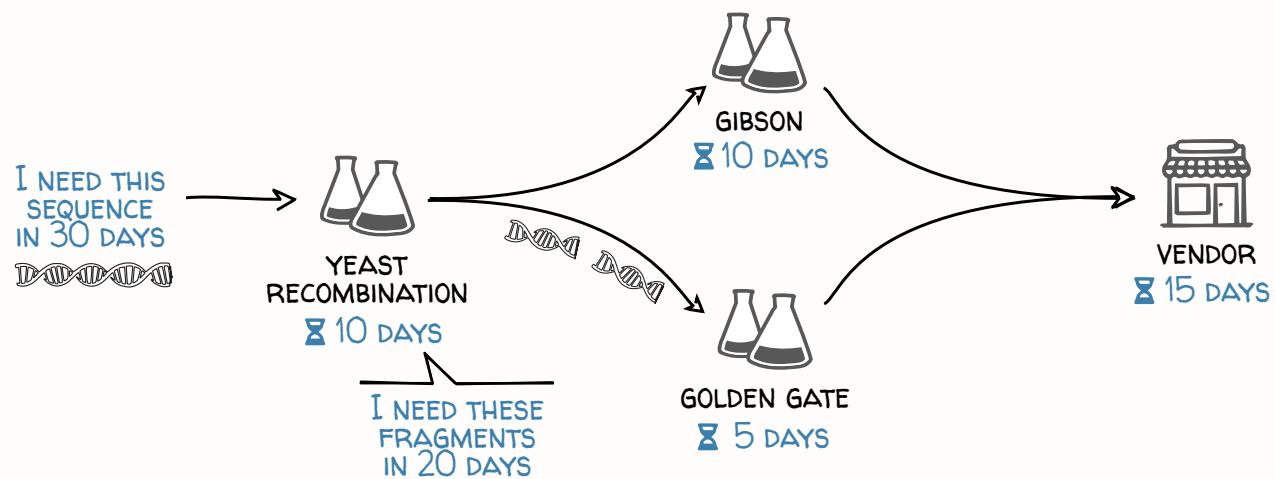
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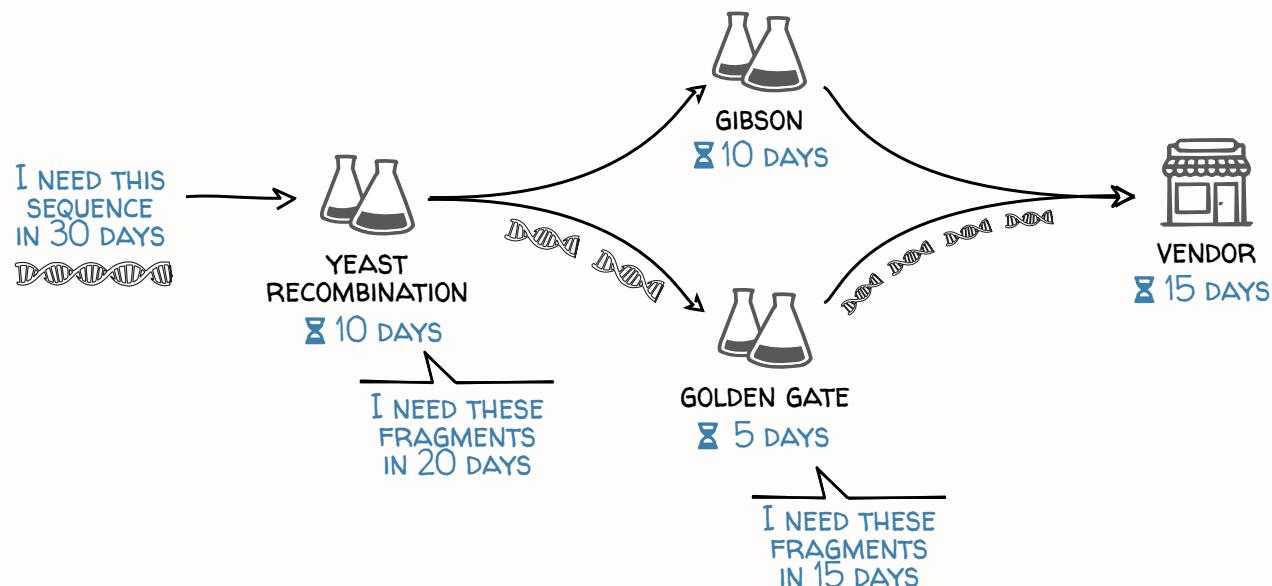
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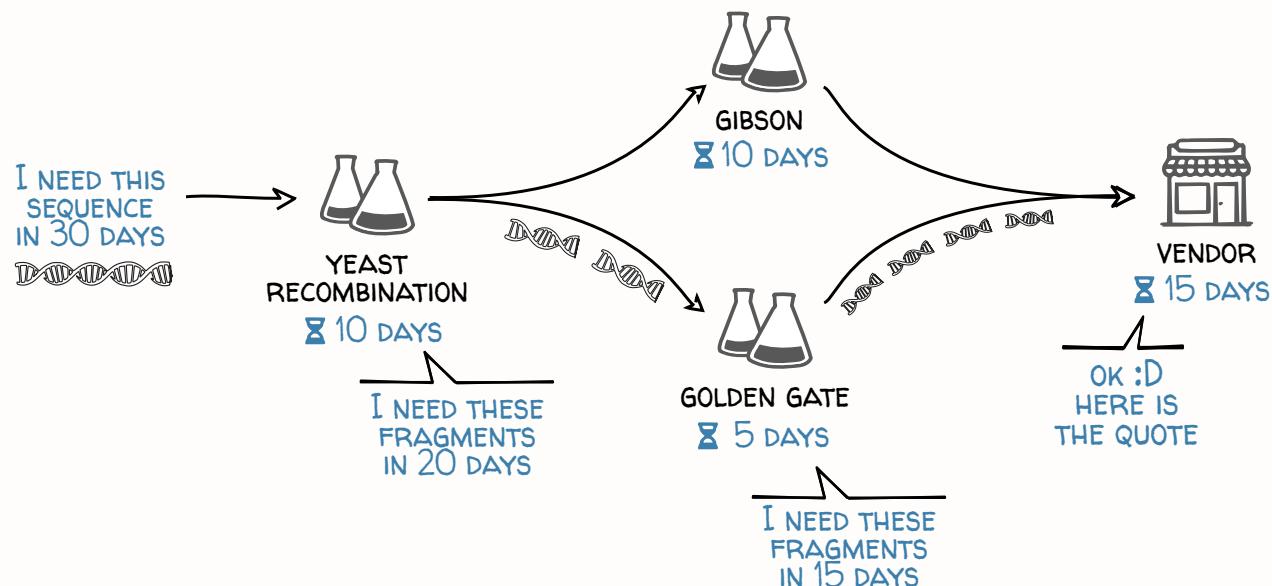
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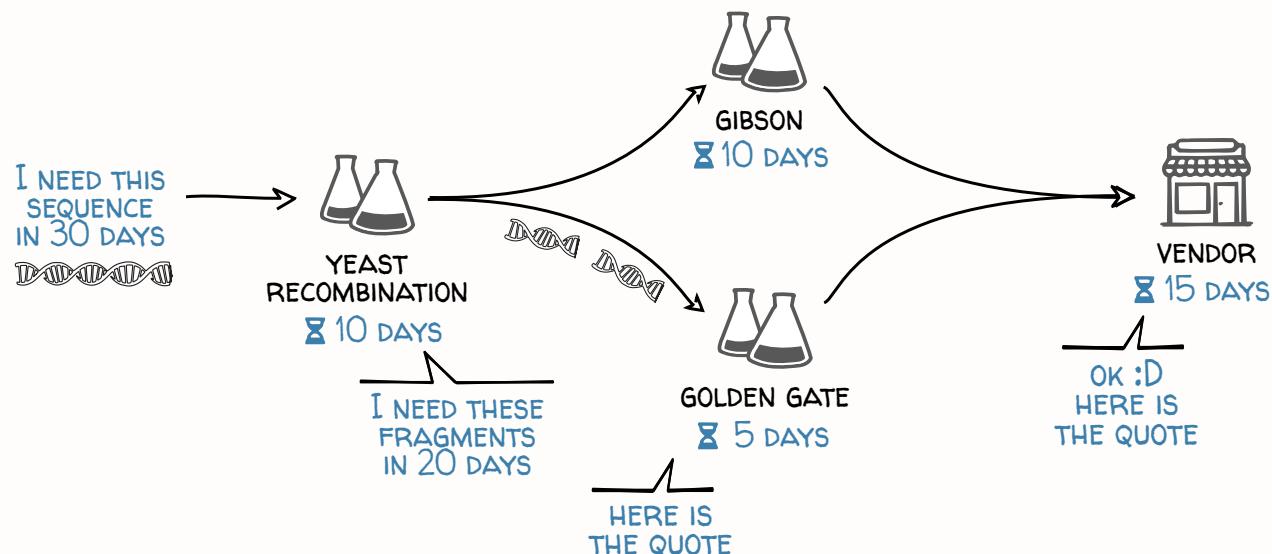
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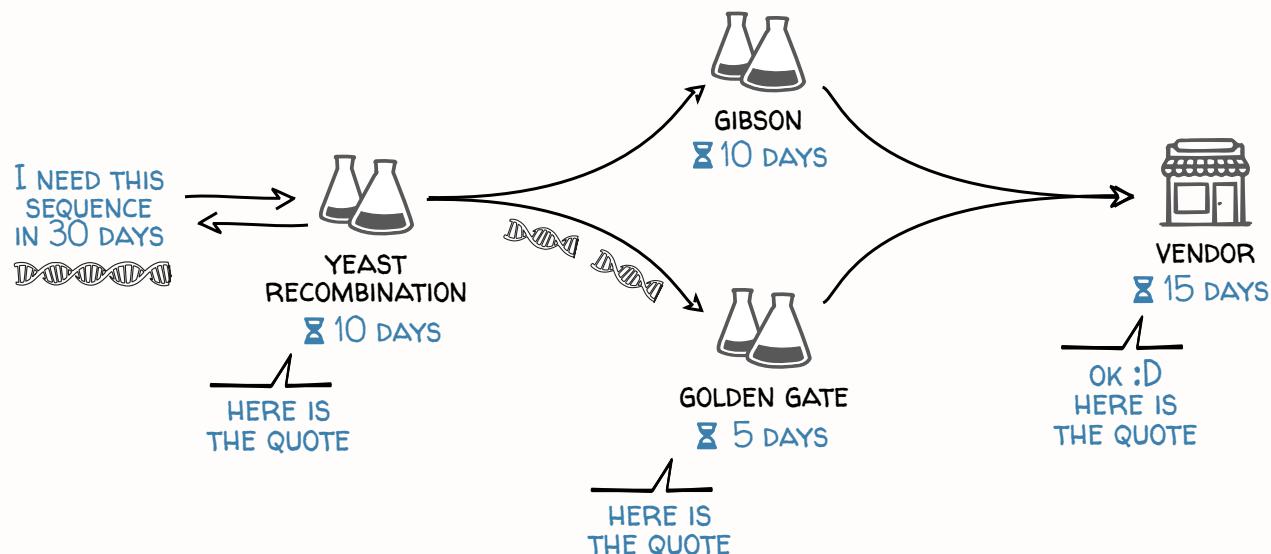
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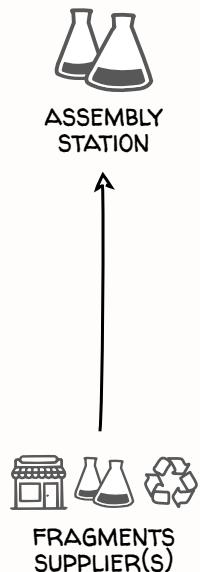
How DNA Weaver decomposes sequences into fragments

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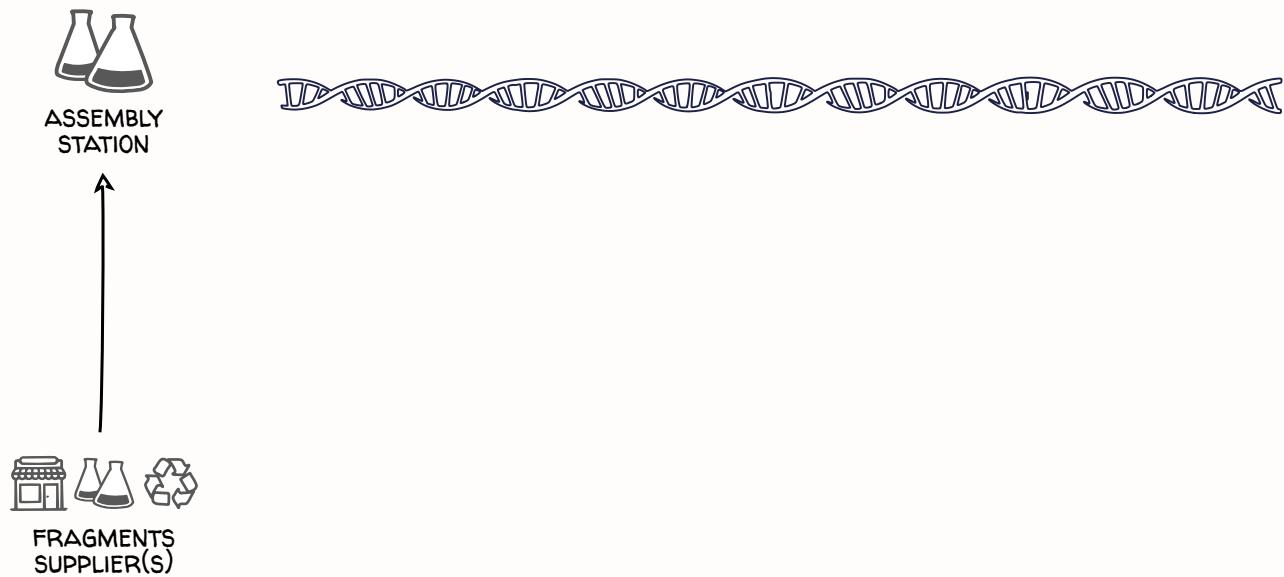


ASSEMBLY
STATION

How DNA Weaver decomposes sequences into fragments



How DNA Weaver decomposes sequences into fragments

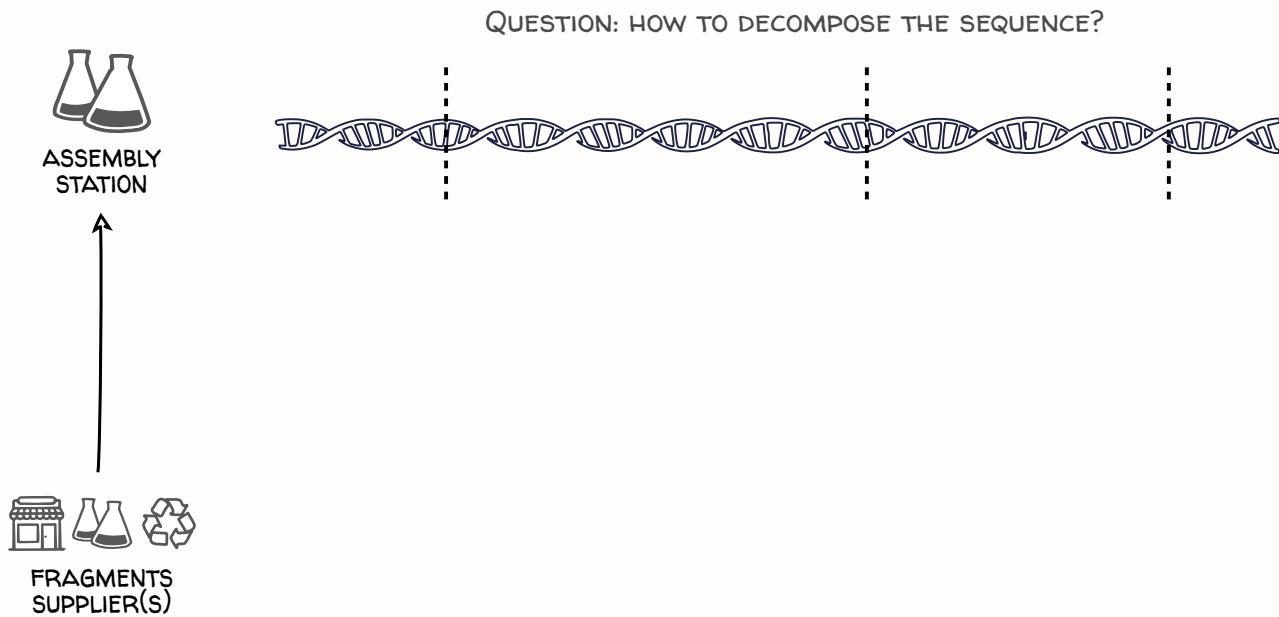


How DNA Weaver decomposes sequences into fragments

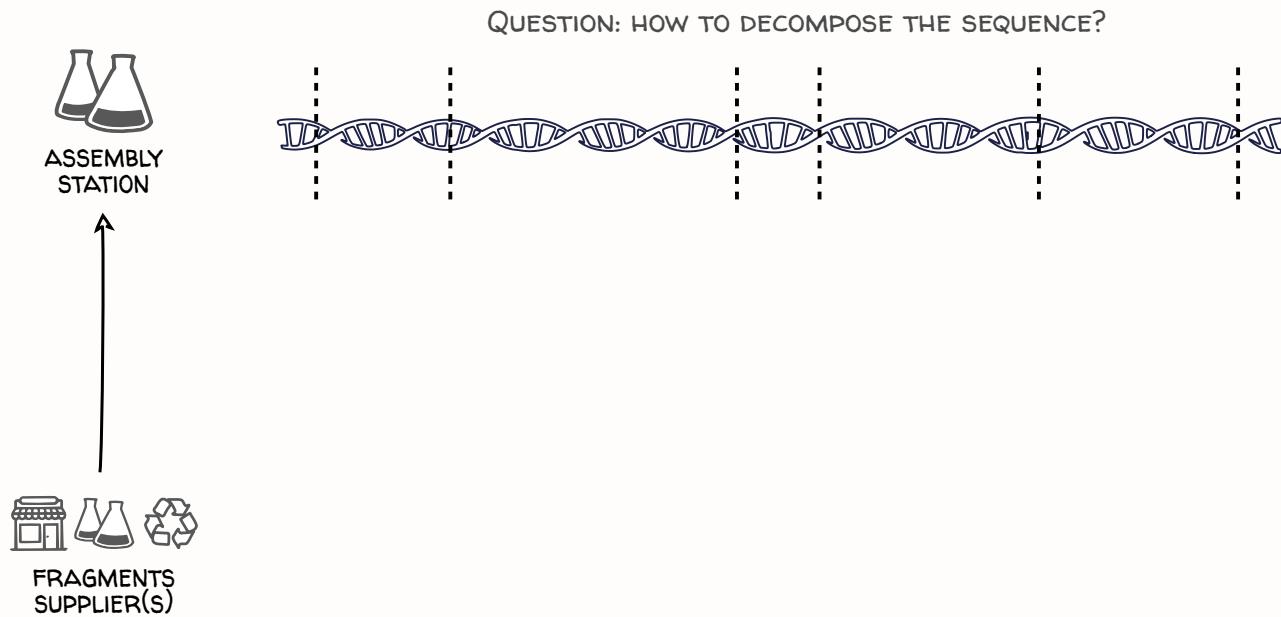
QUESTION: HOW TO DECOMPOSE THE SEQUENCE?



How DNA Weaver decomposes sequences into fragments



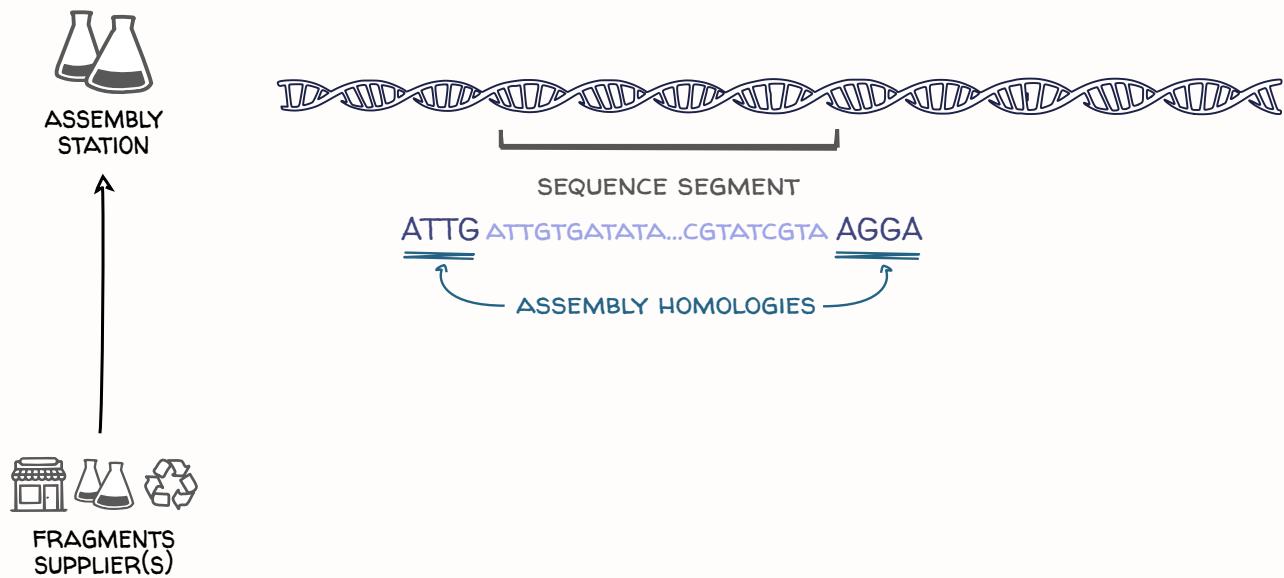
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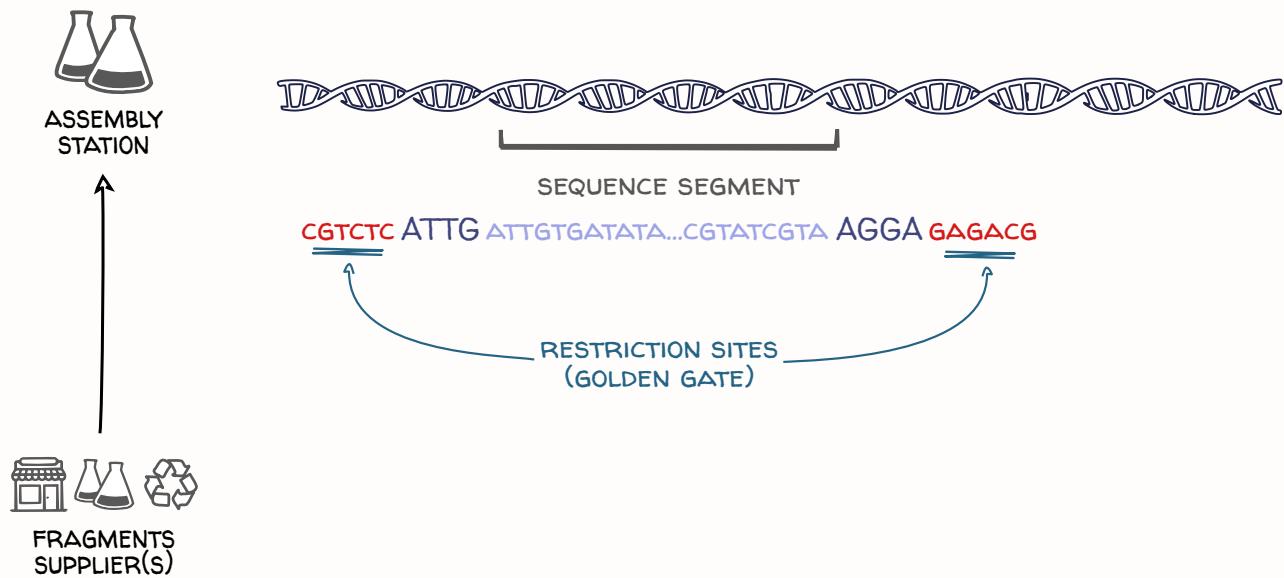
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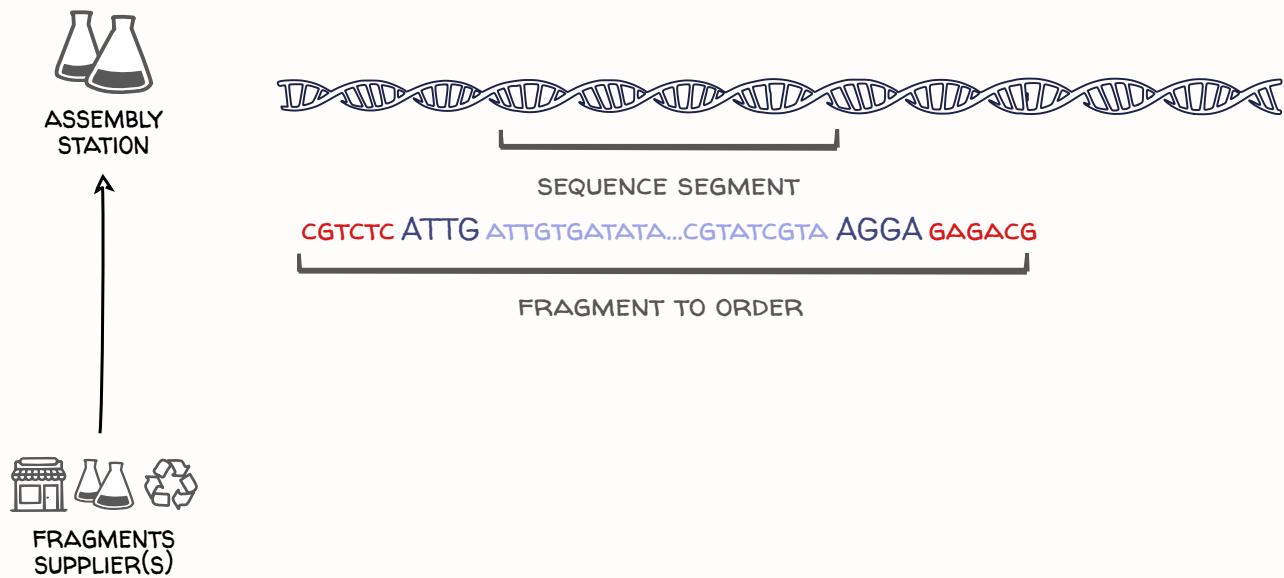
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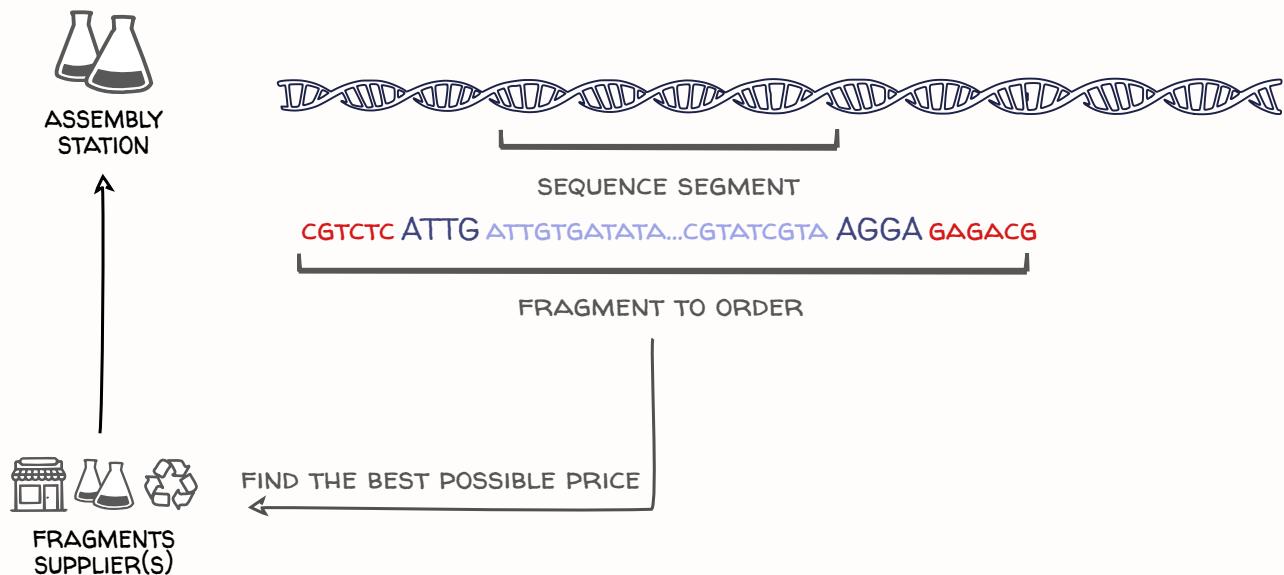
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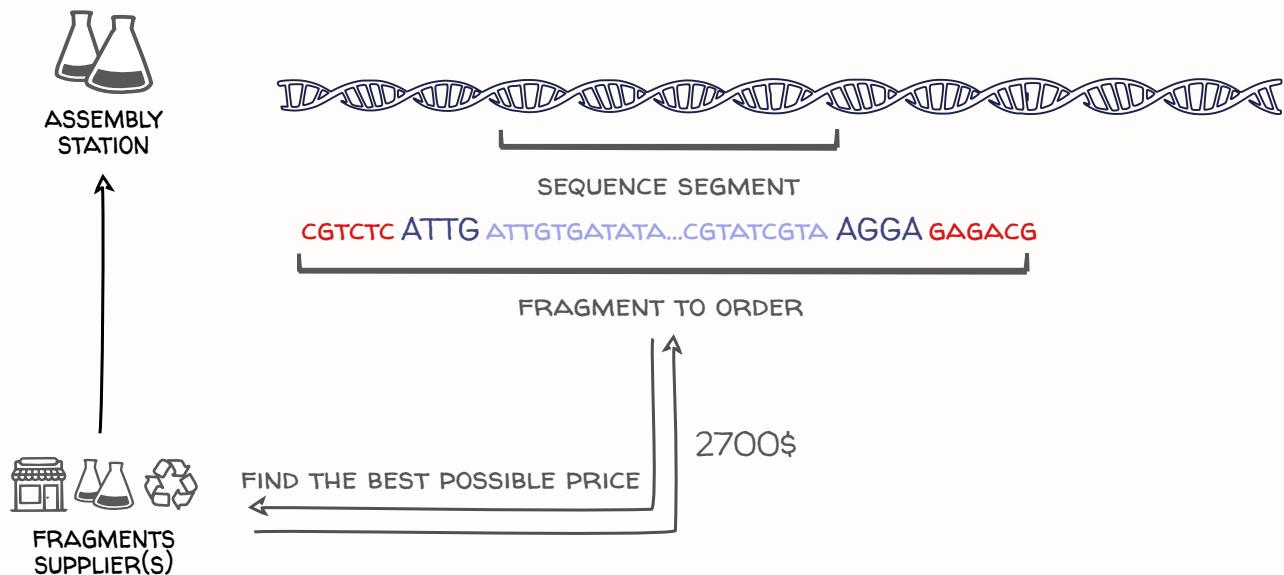
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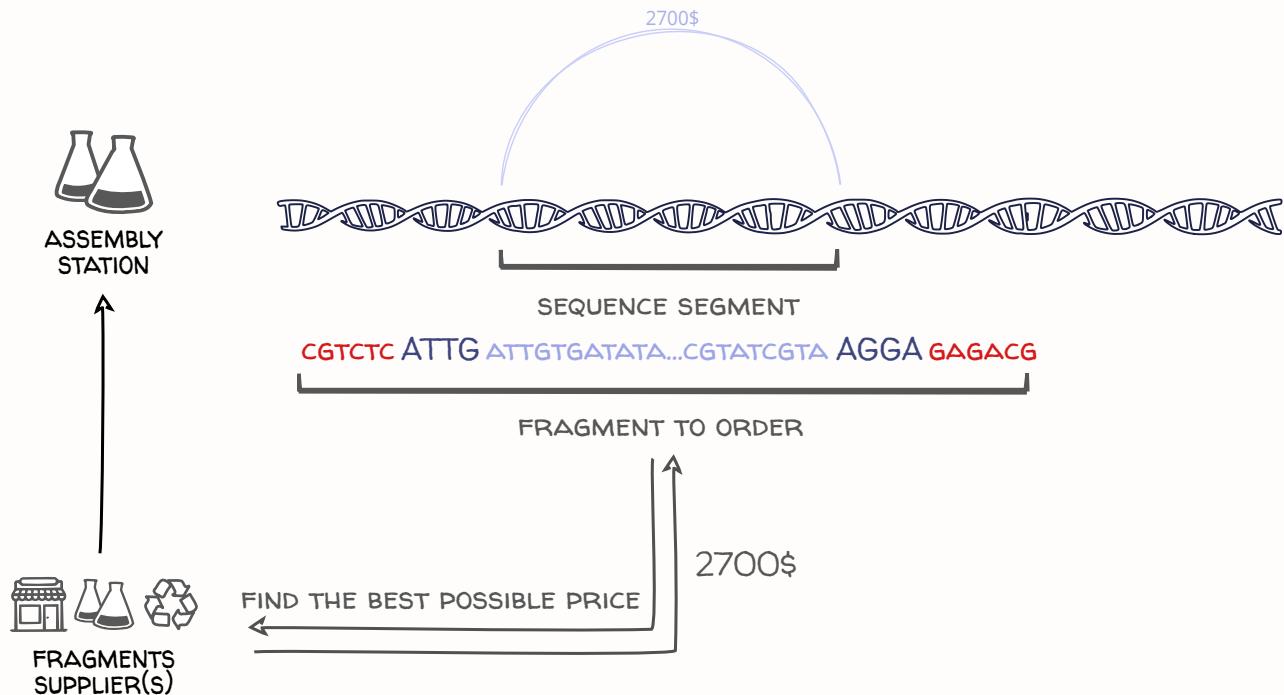
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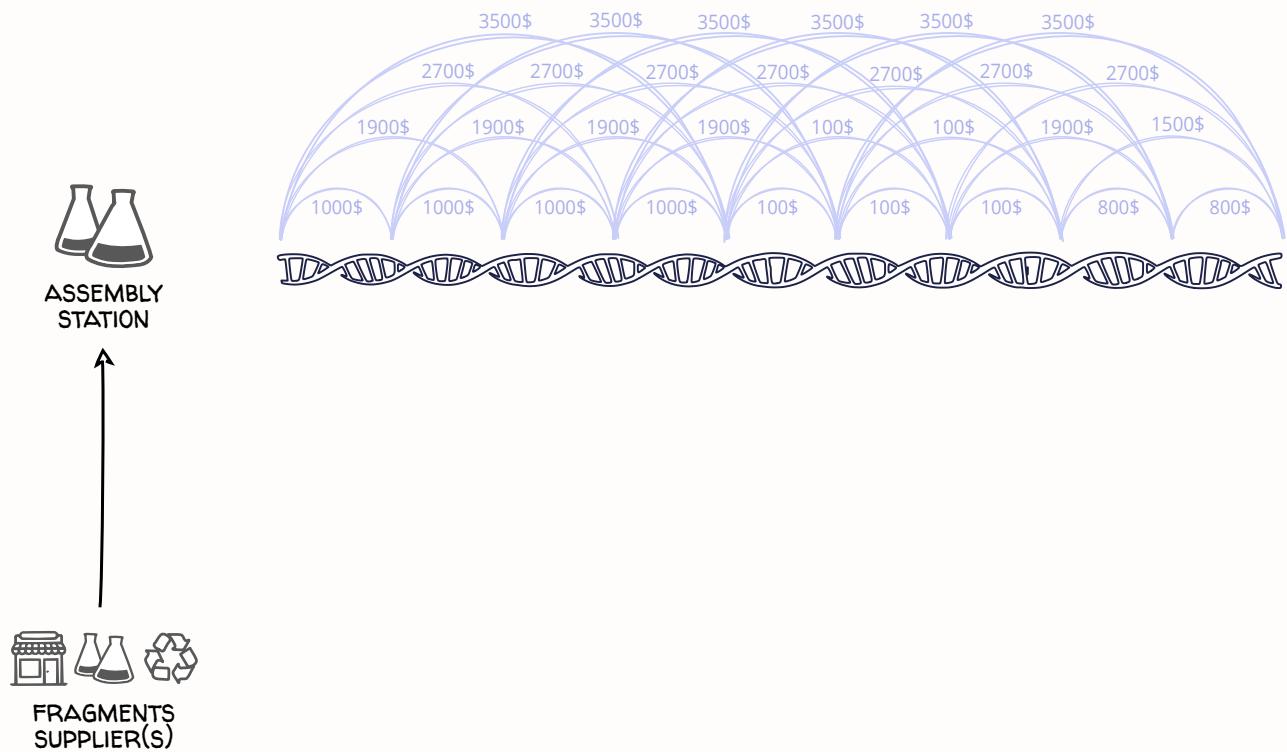
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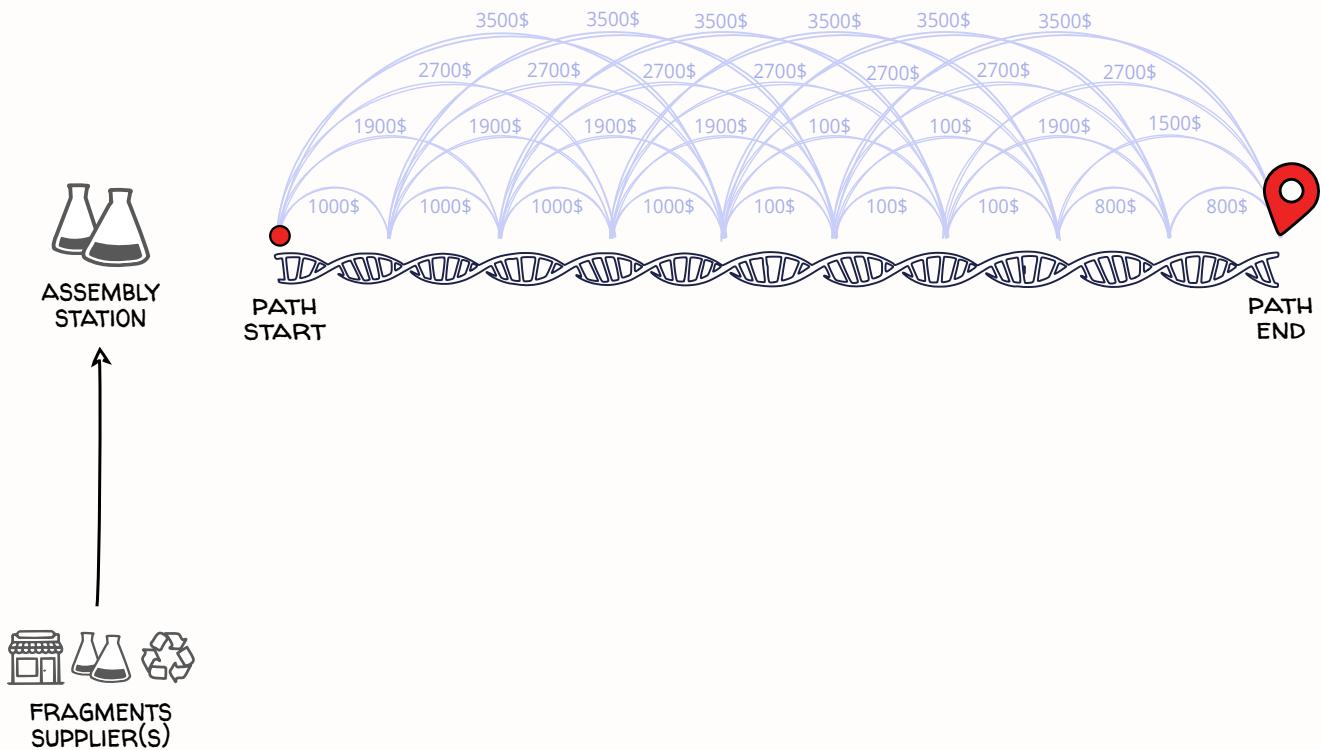
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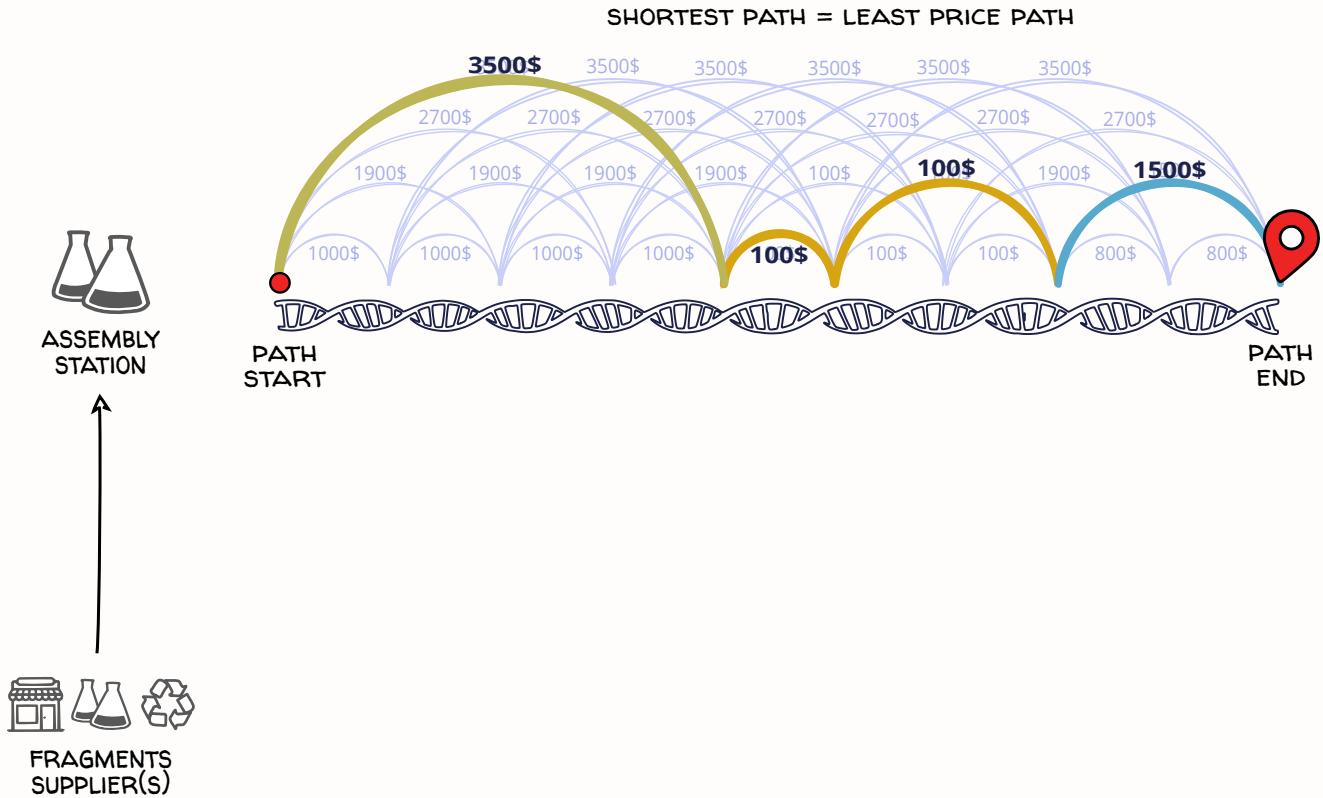
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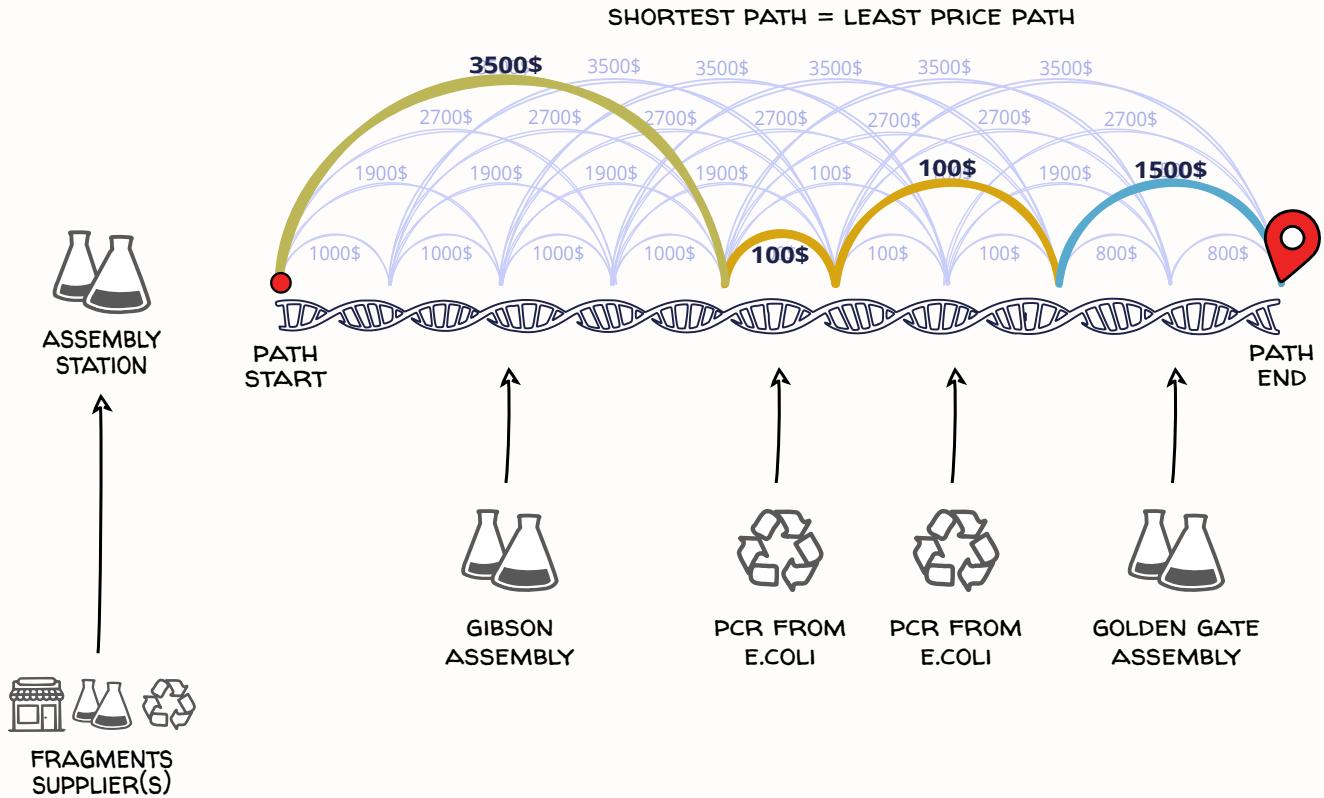
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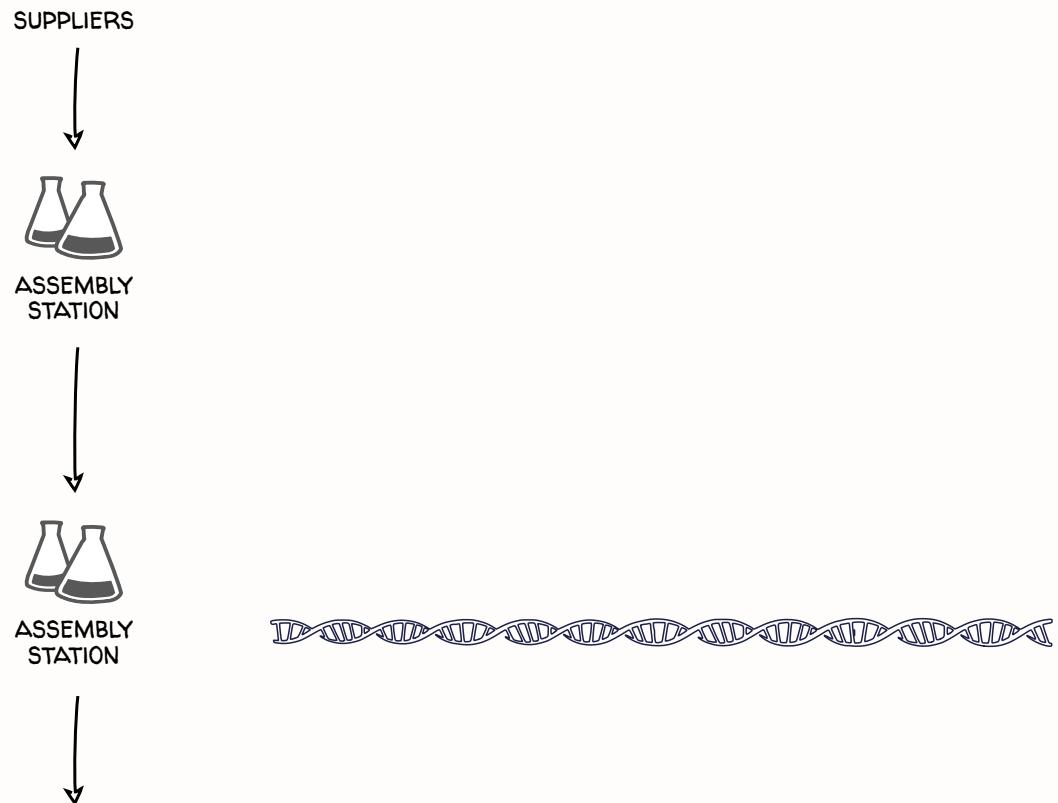


Note: the complexity explodes with assembly steps

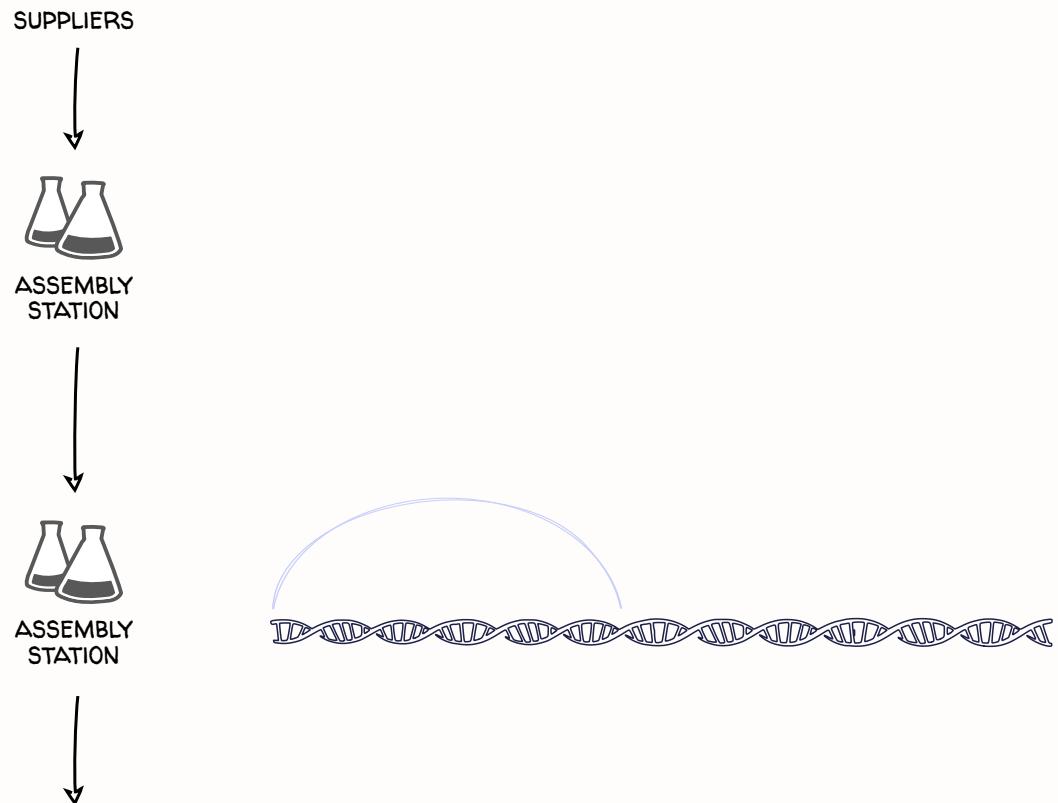
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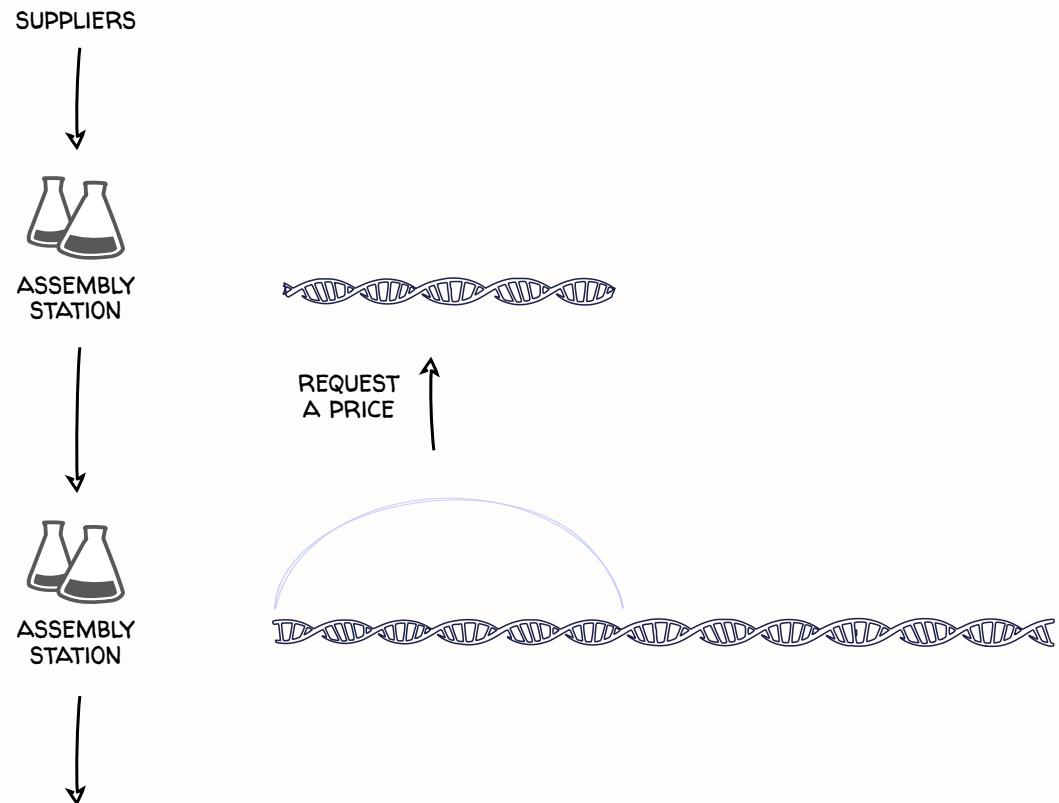
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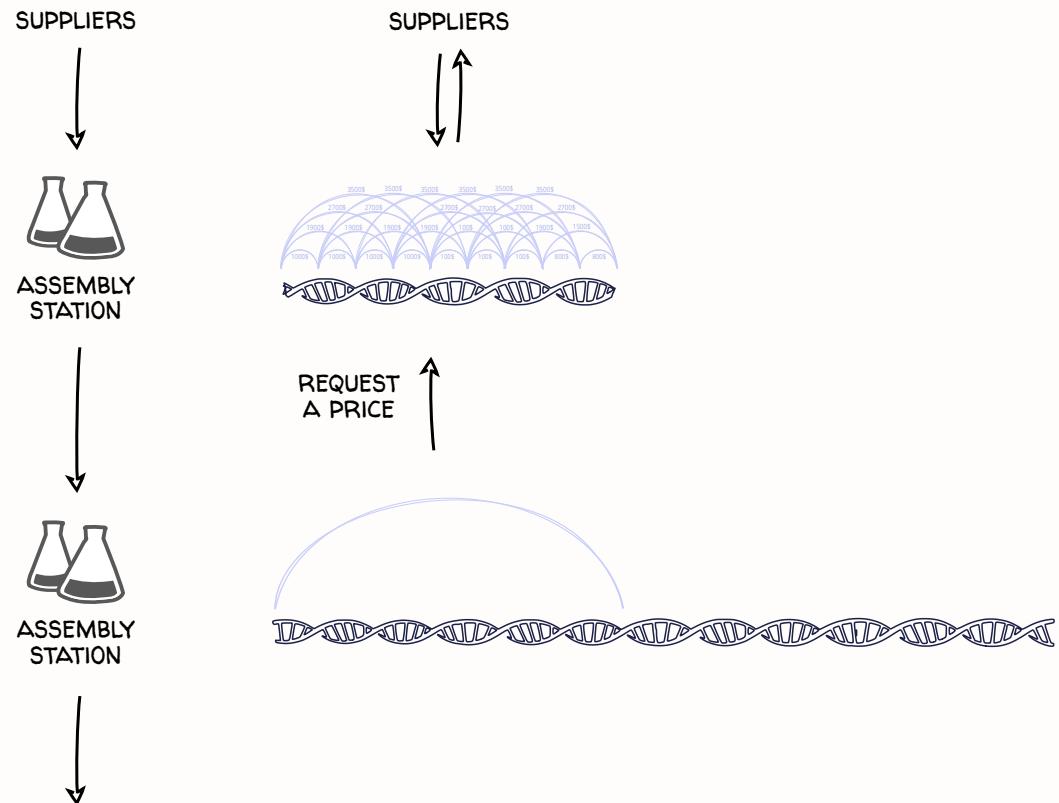
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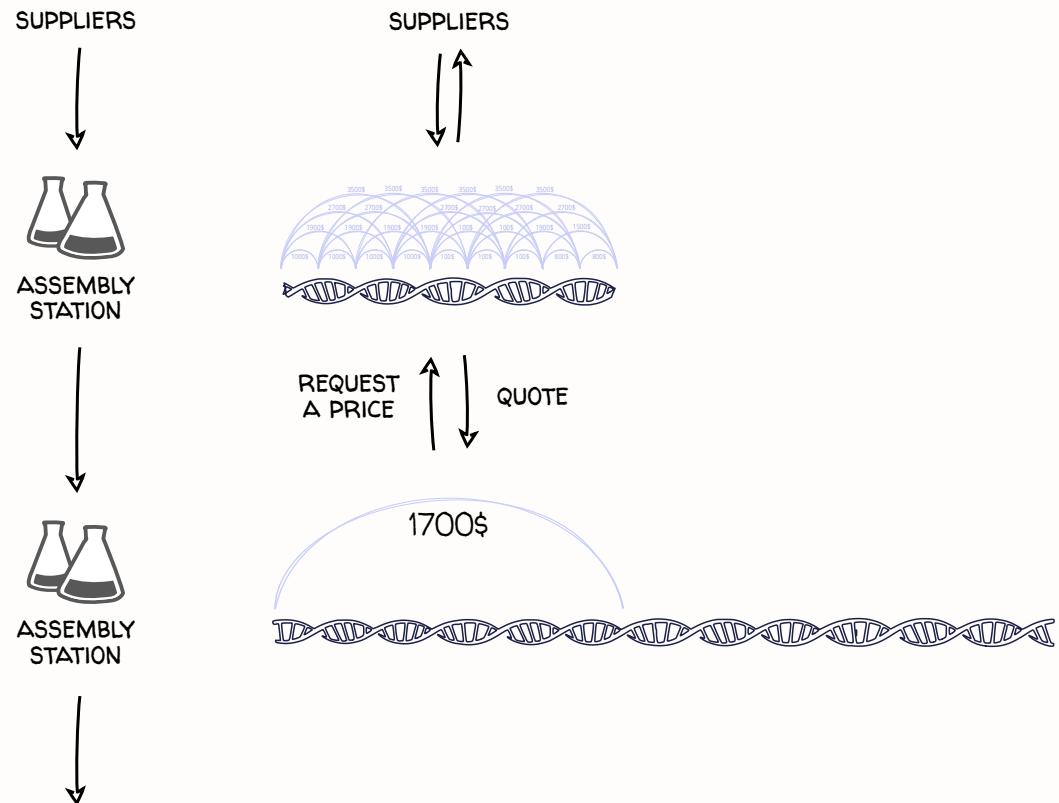
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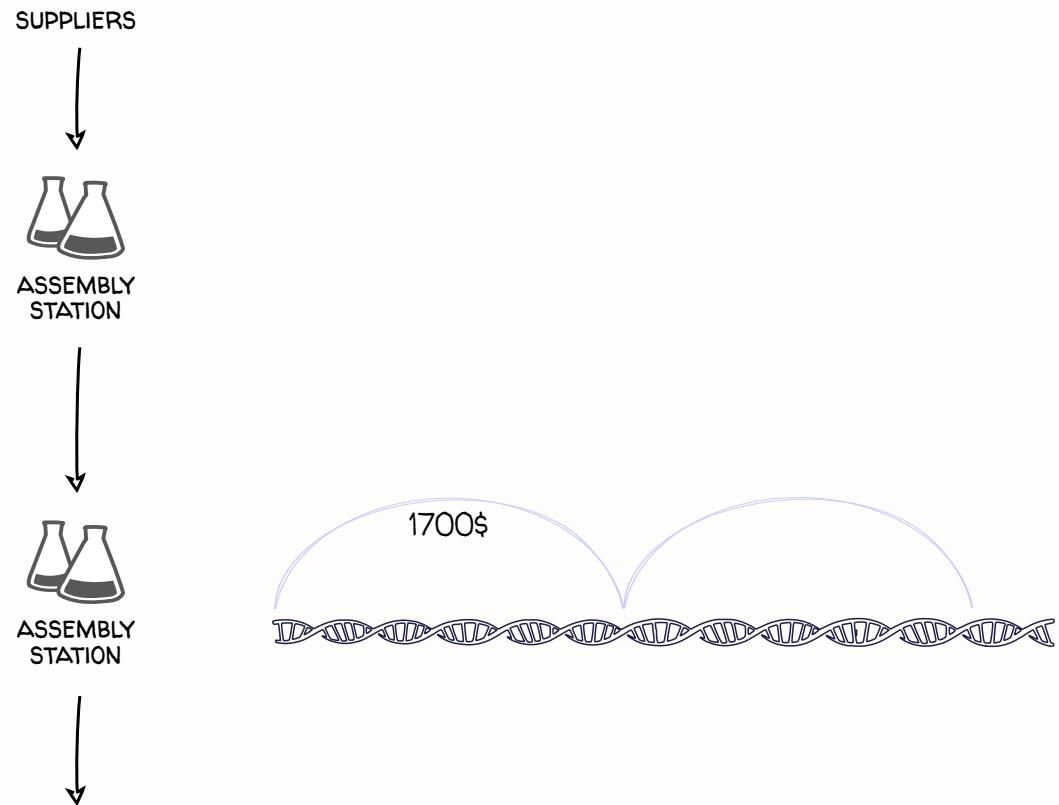
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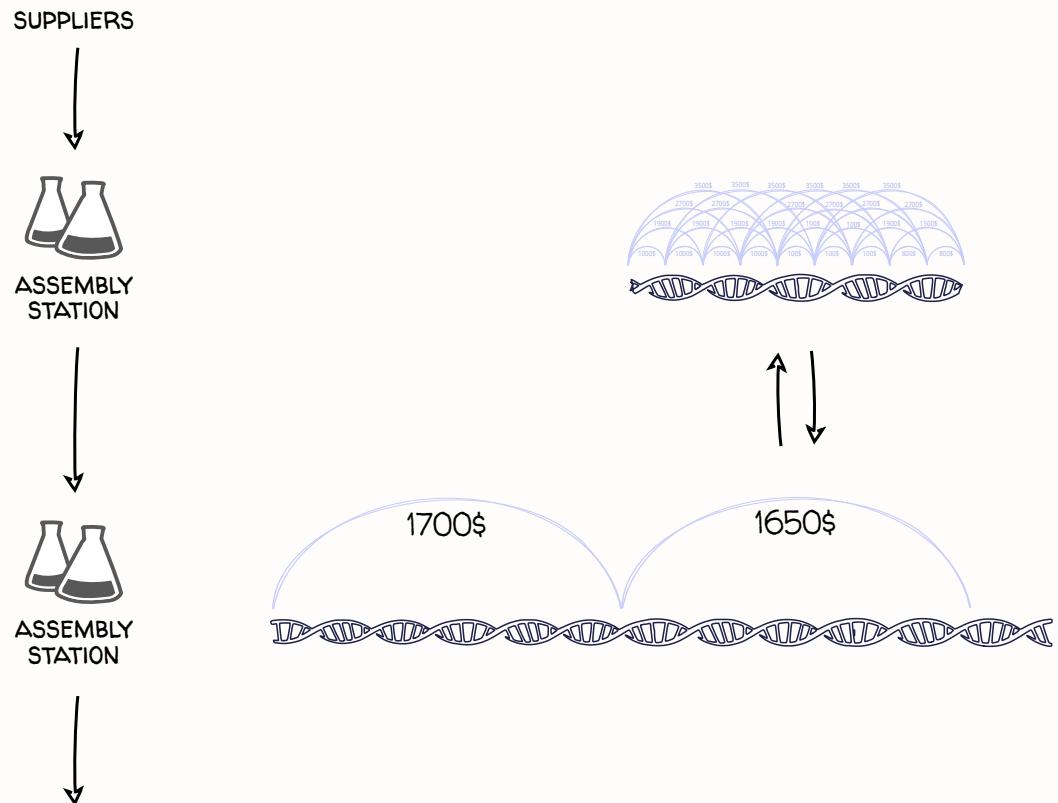
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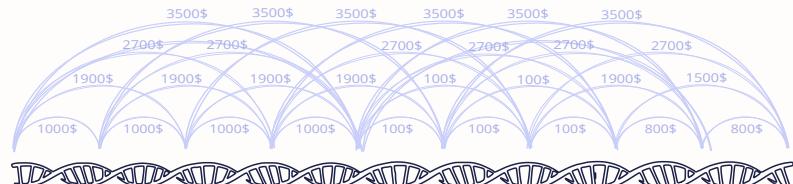
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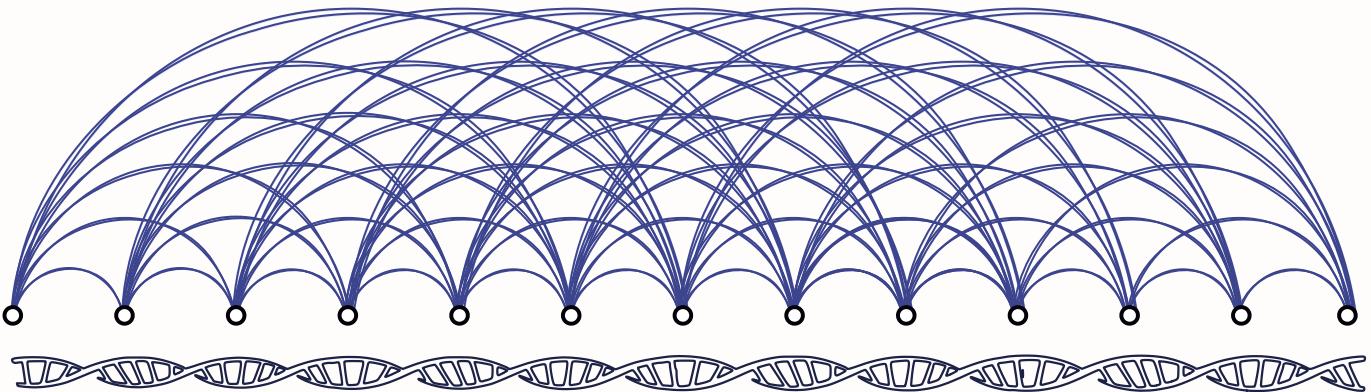


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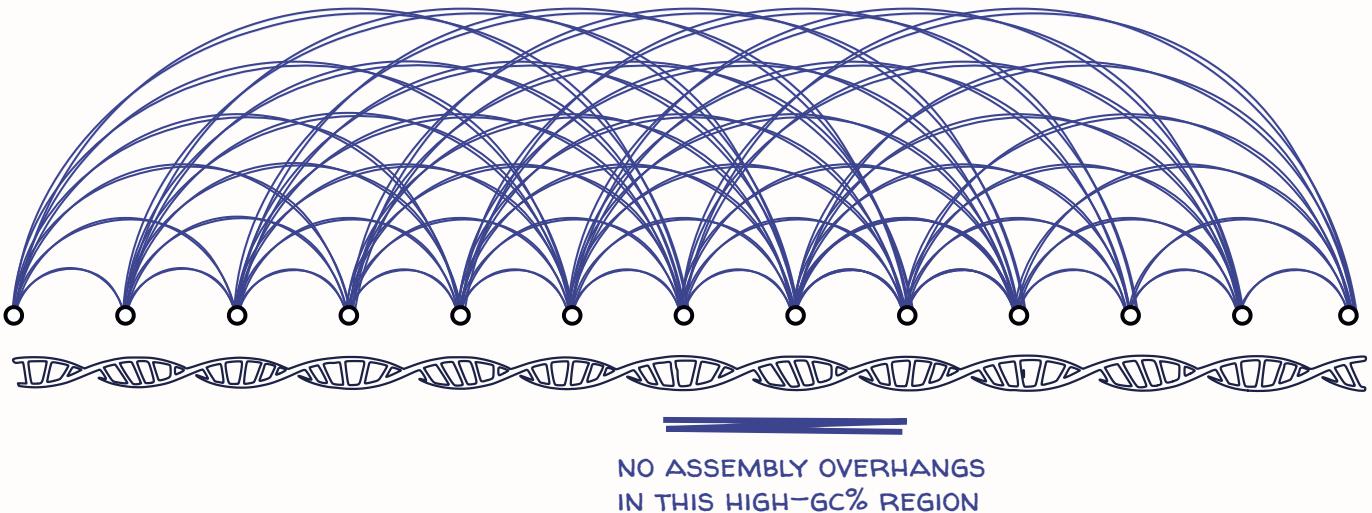


Graph operations can reflect practical constraints

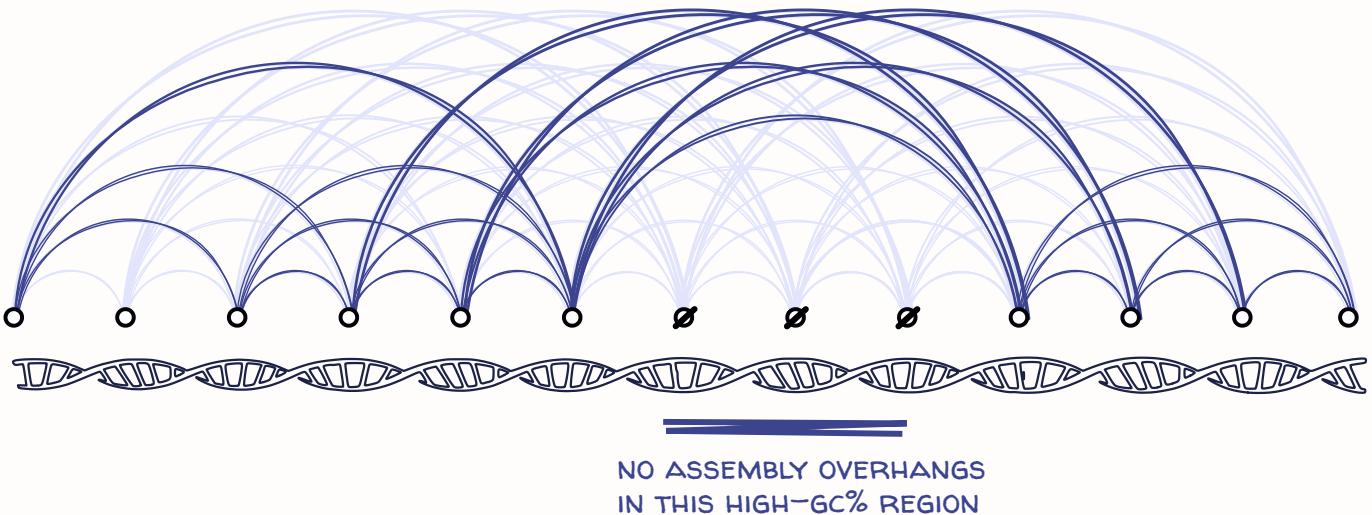
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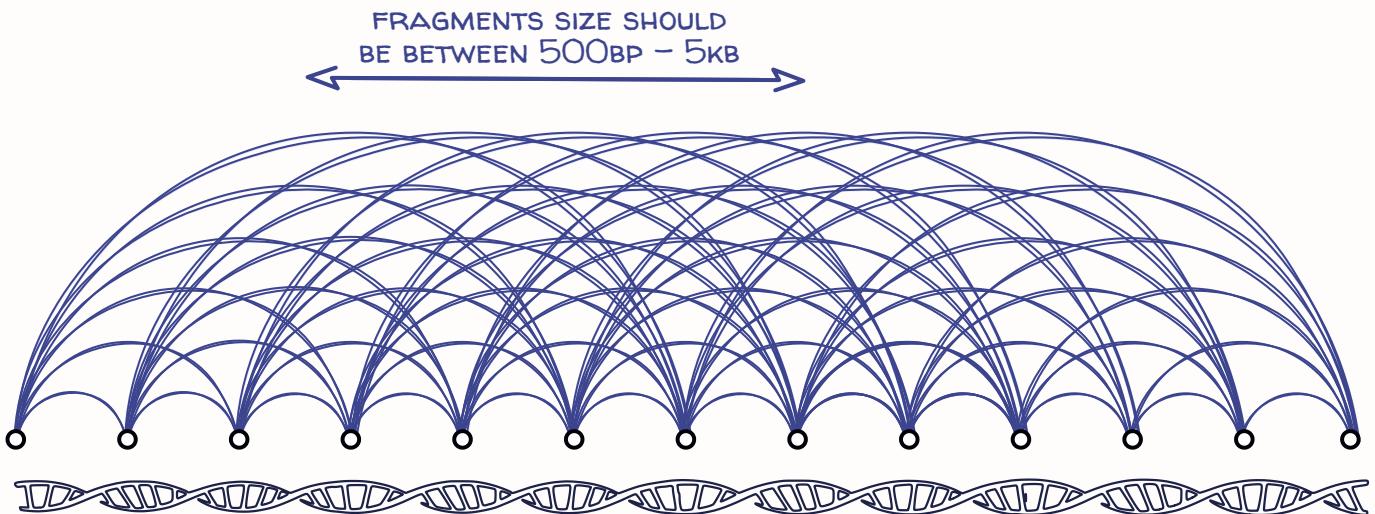
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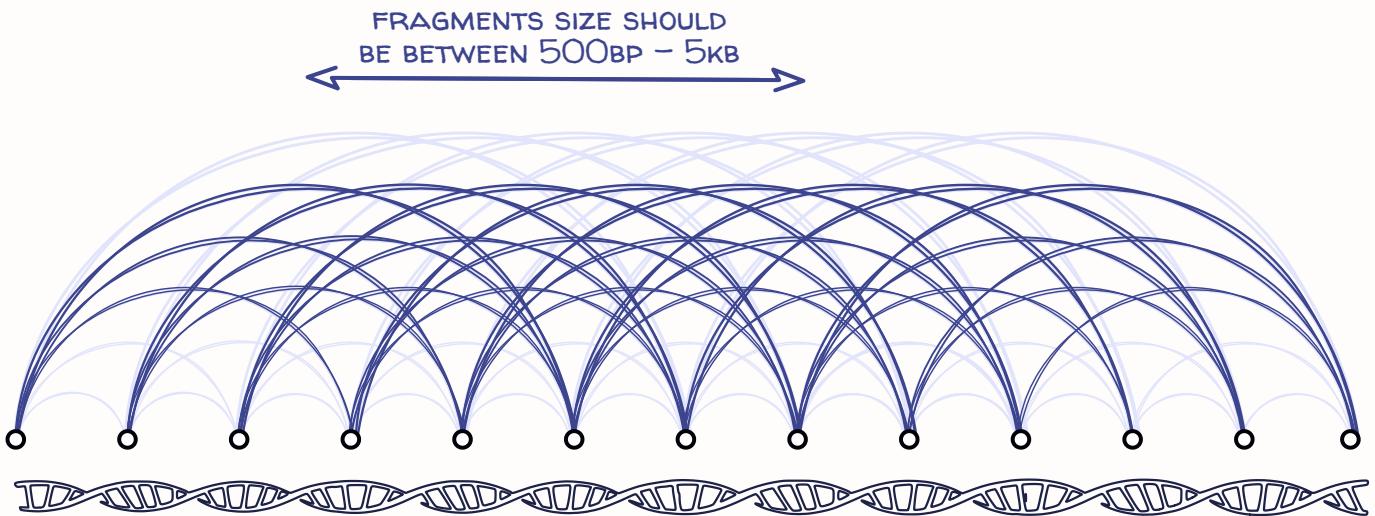
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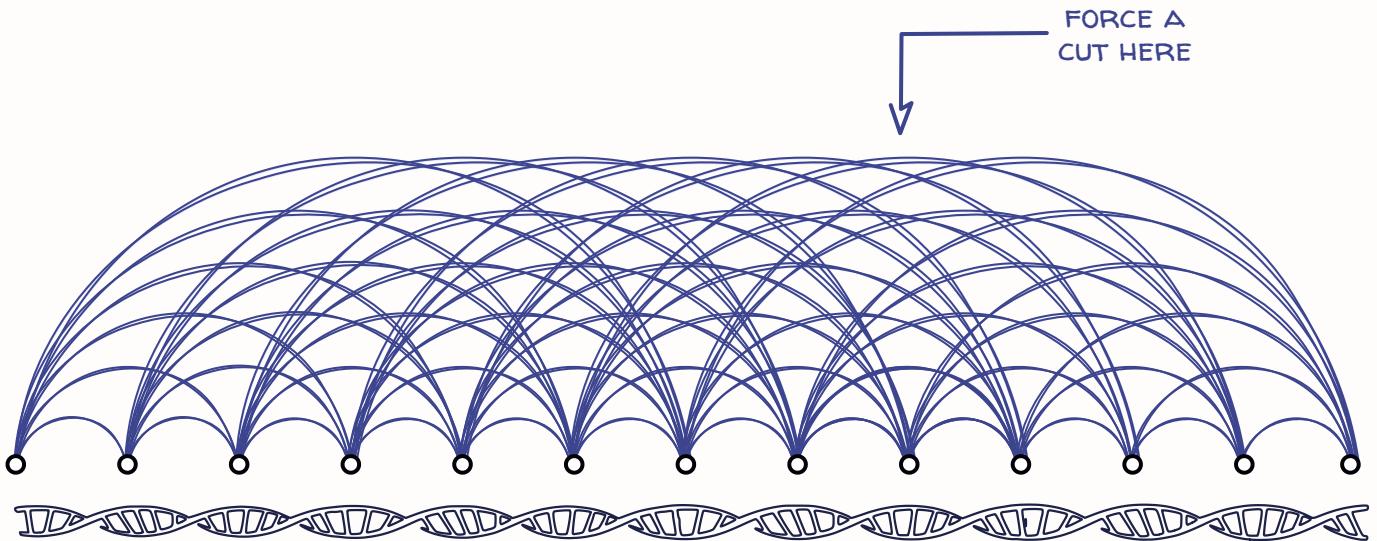
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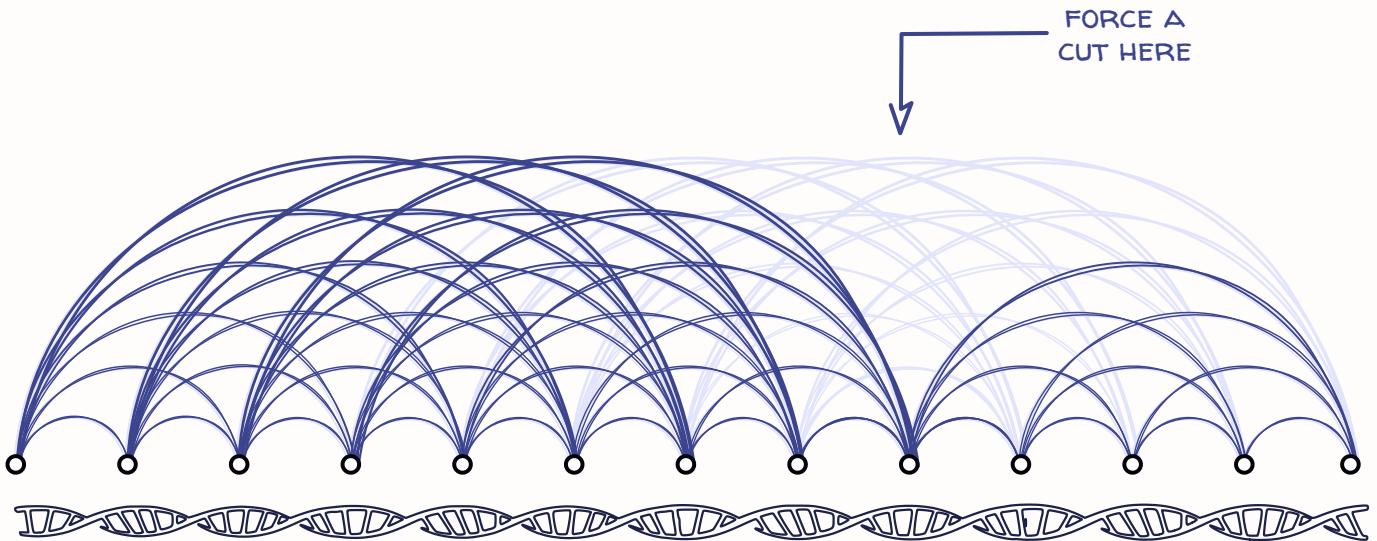
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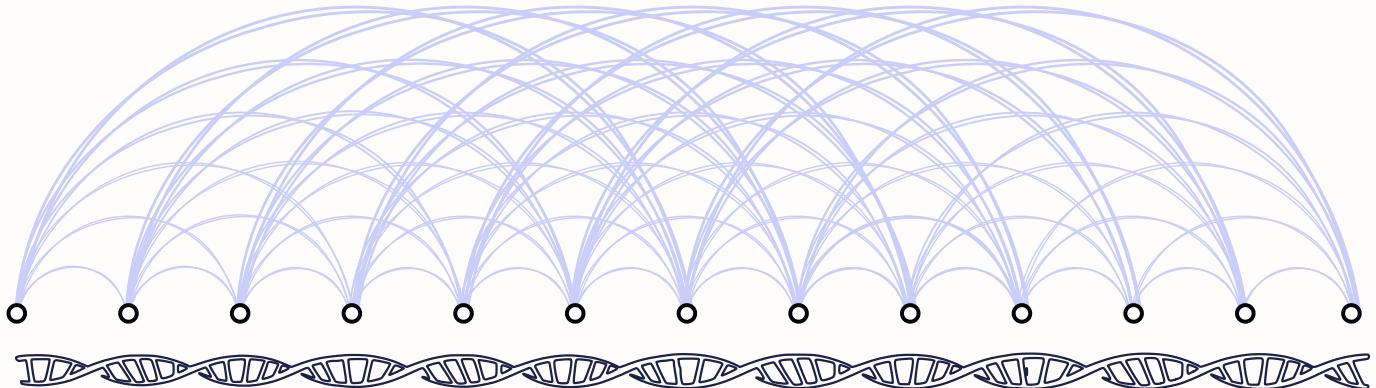


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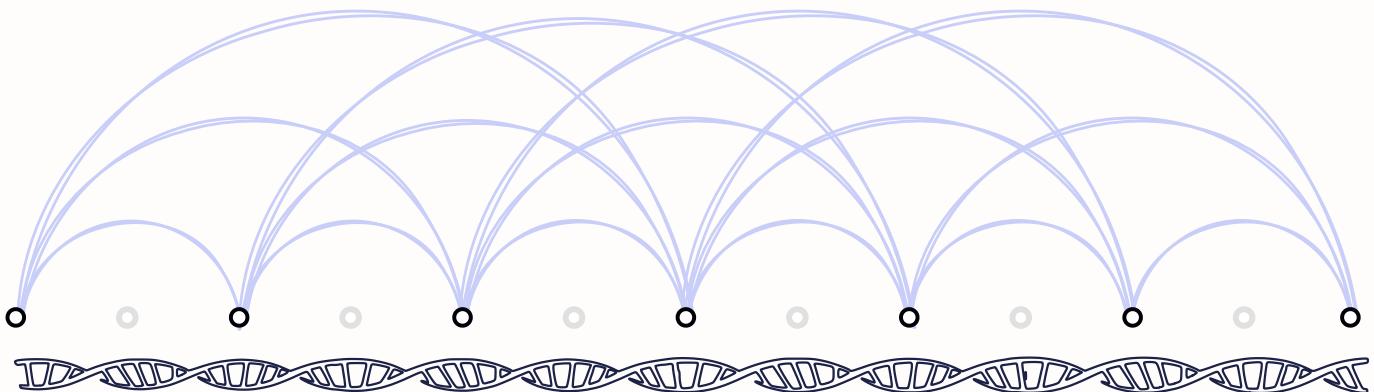


Nucleotide skipping for faster sequence decomposition

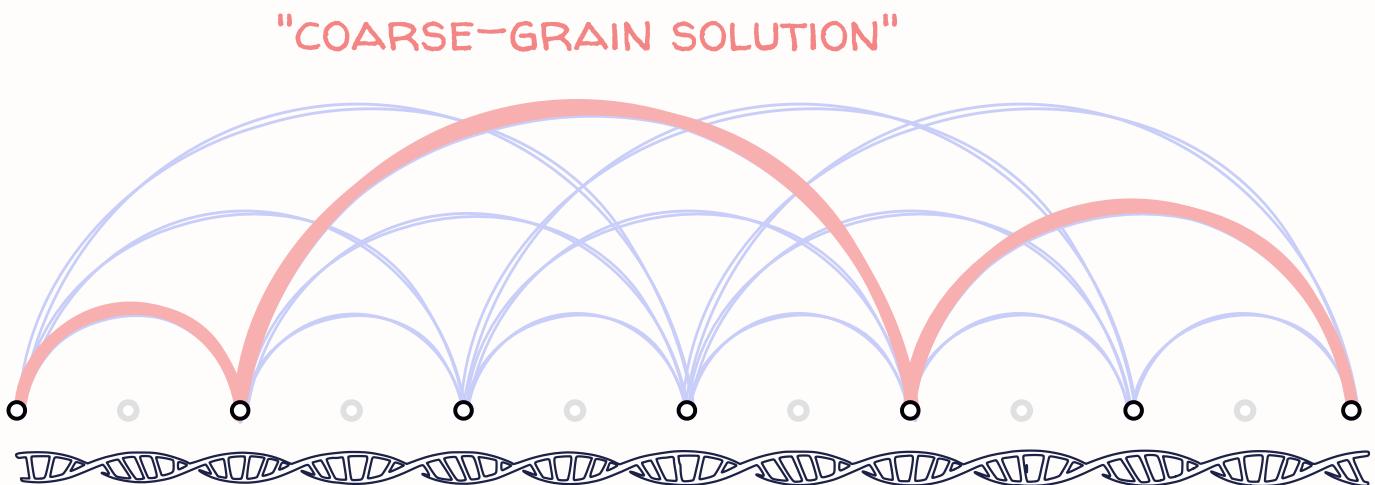
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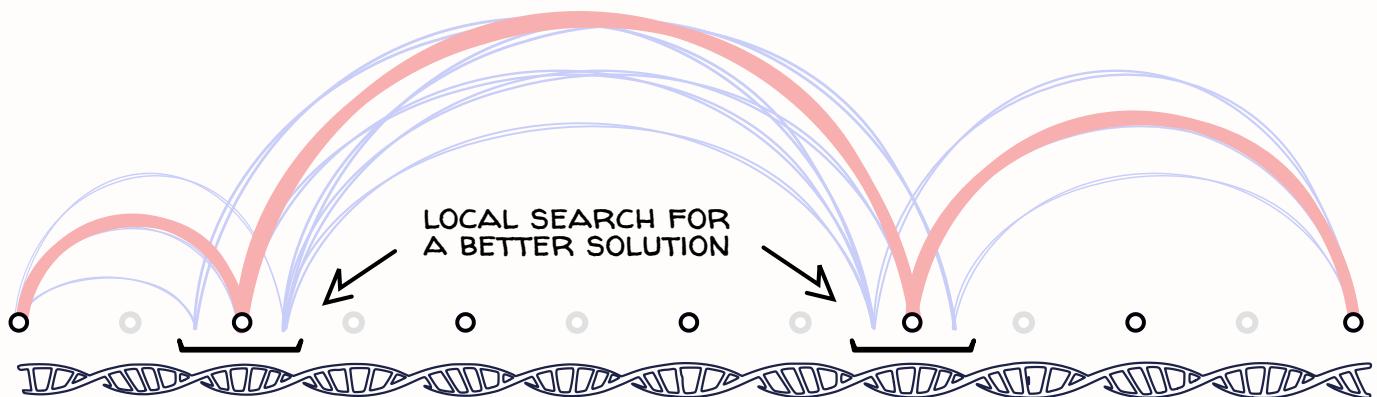
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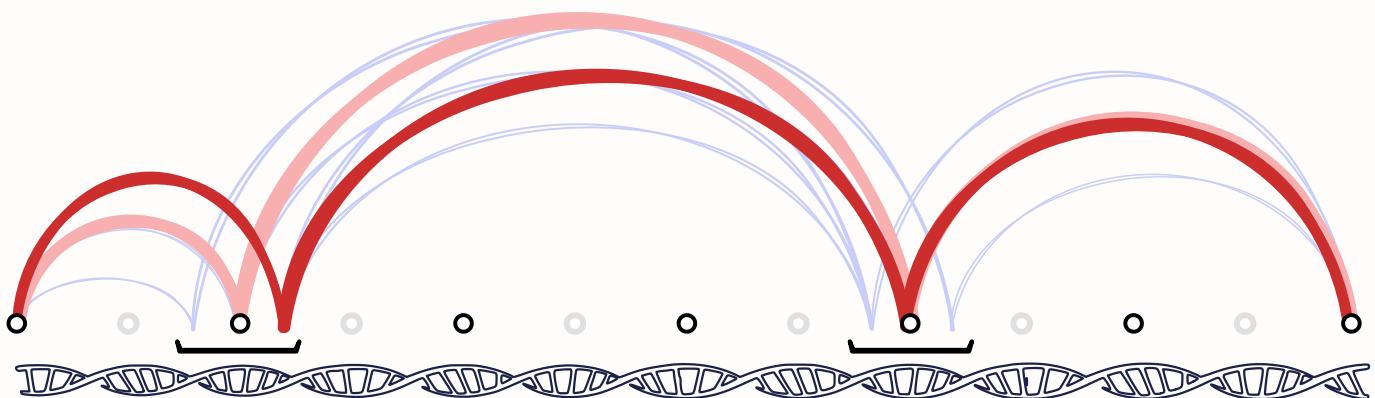


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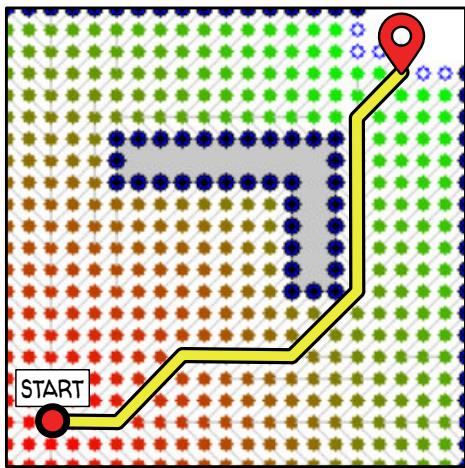
"REFINED SOLUTION"



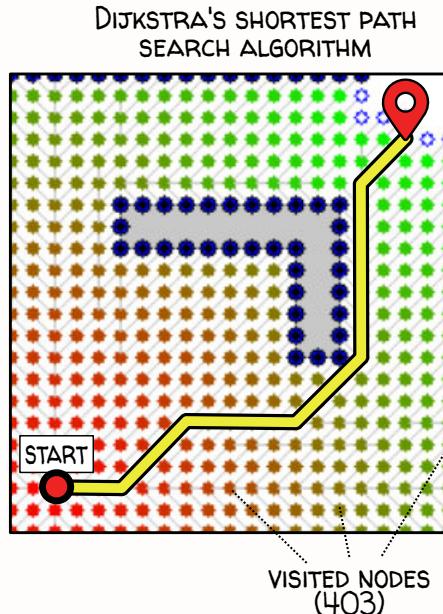
Accelerating sequence decomposition with the A* algorithm

Accelerating sequence decomposition with the A* algorithm

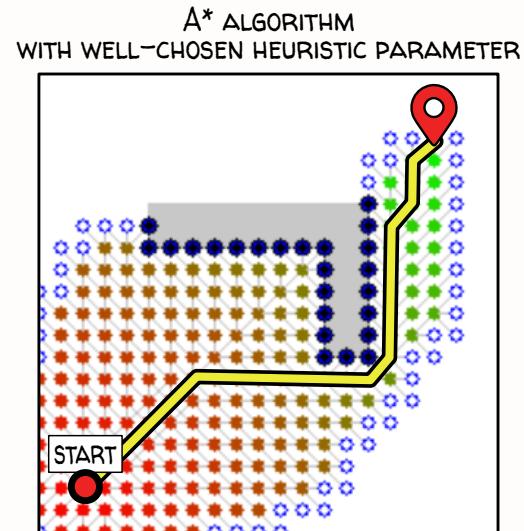
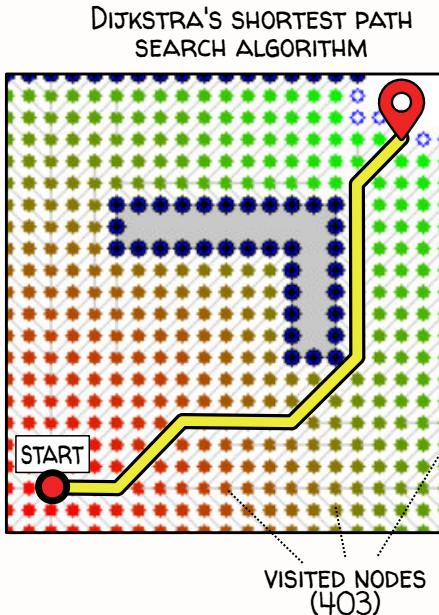
DIJKSTRA'S SHORTEST PATH
SEARCH ALGORITHM



Accelerating sequence decomposition with the A* algorithm

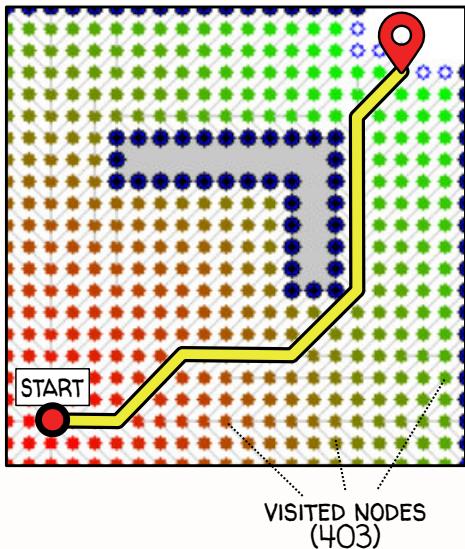


Accelerating sequence decomposition with the A* algorithm

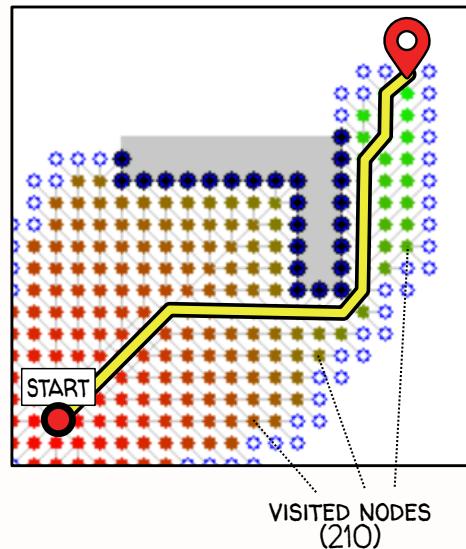


Accelerating sequence decomposition with the A* algorithm

DIJKSTRA'S SHORTEST PATH
SEARCH ALGORITHM

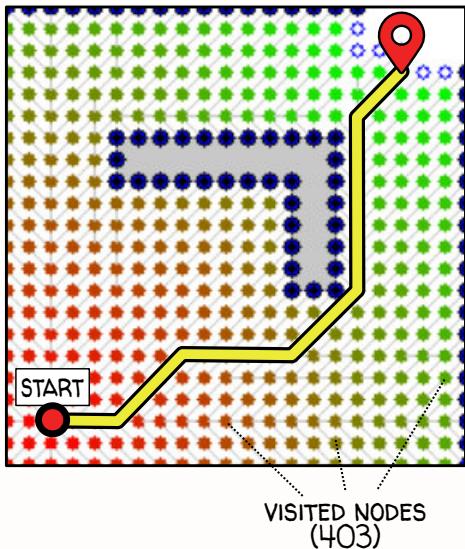


A* ALGORITHM
WITH WELL-CHOOSEN HEURISTIC PARAMETER

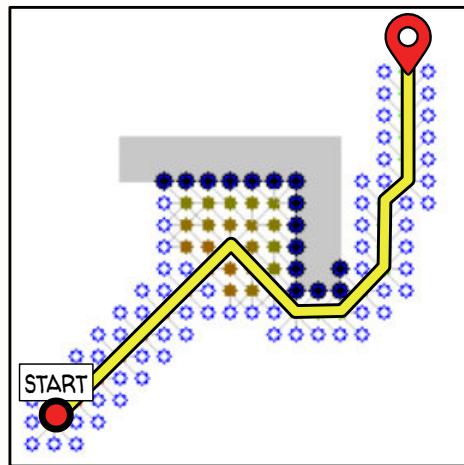


Accelerating sequence decomposition with the A* algorithm

DIJKSTRA'S SHORTEST PATH
SEARCH ALGORITHM

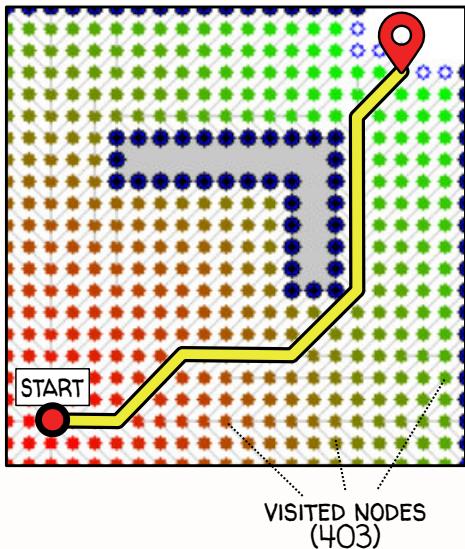


A* ALGORITHM
WITH LARGE HEURISTIC PARAMETER

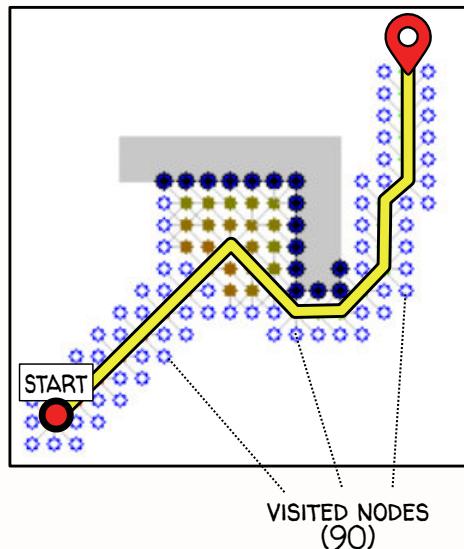


Accelerating sequence decomposition with the A* algorithm

DIJKSTRA'S SHORTEST PATH
SEARCH ALGORITHM

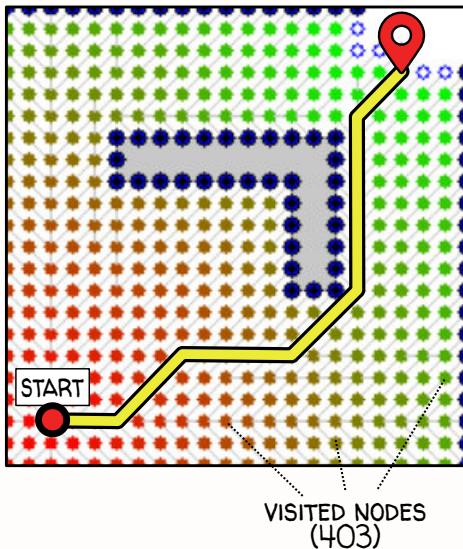


A* ALGORITHM
WITH LARGE HEURISTIC PARAMETER

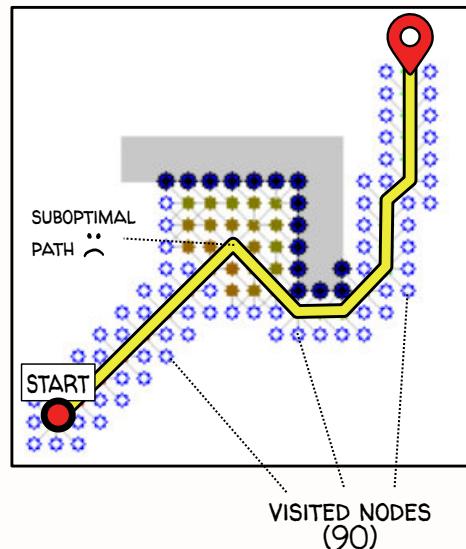


Accelerating sequence decomposition with the A* algorithm

DIJKSTRA'S SHORTEST PATH
SEARCH ALGORITHM



A* ALGORITHM
WITH LARGE HEURISTIC PARAMETER



Accelerating sequence decomposition with the A* algorithm

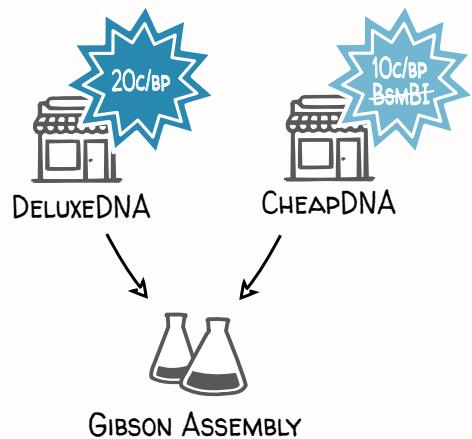


Age of Empires uses A* for moving AI-controlled units

Accelerating sequence decomposition with the A* algorithm

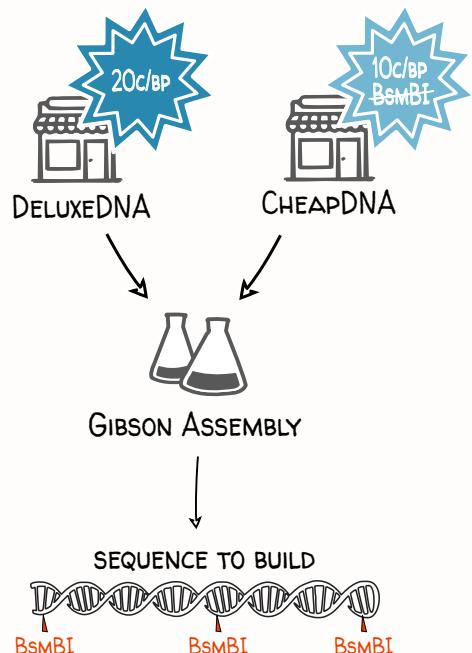
Accelerating sequence decomposition with the A* algorithm

PROBLEM



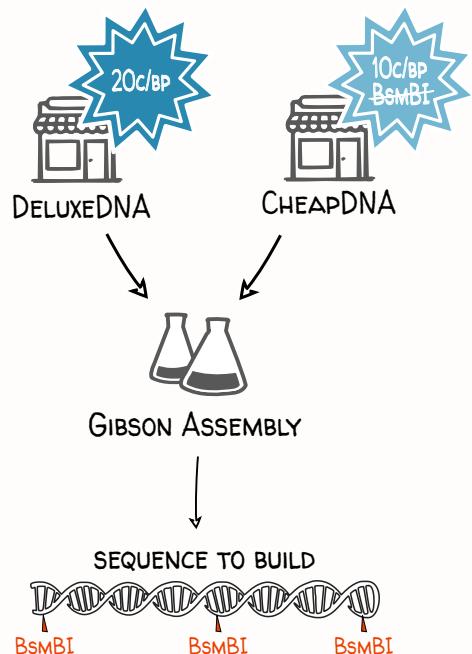
Accelerating sequence decomposition with the A* algorithm

PROBLEM

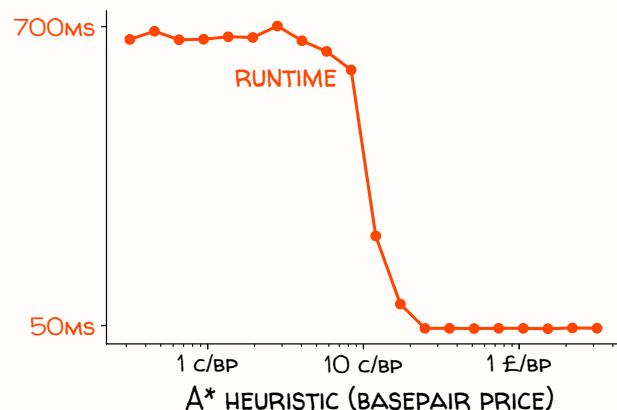


Accelerating sequence decomposition with the A* algorithm

PROBLEM

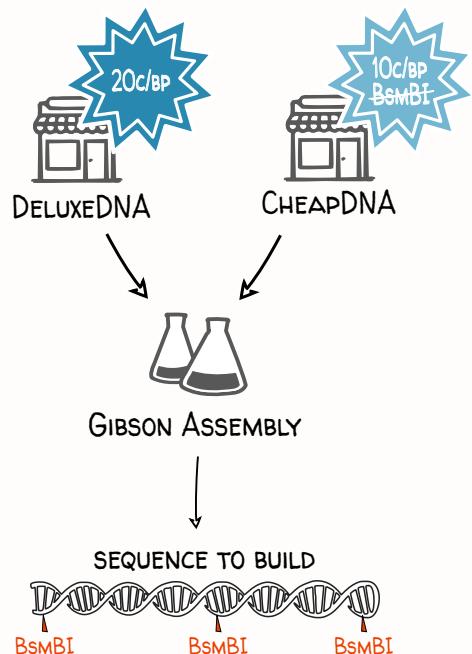


A* RESOLUTION

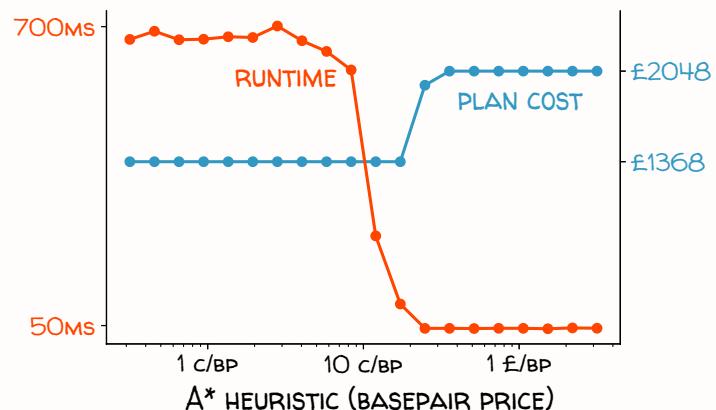


Accelerating sequence decomposition with the A* algorithm

PROBLEM

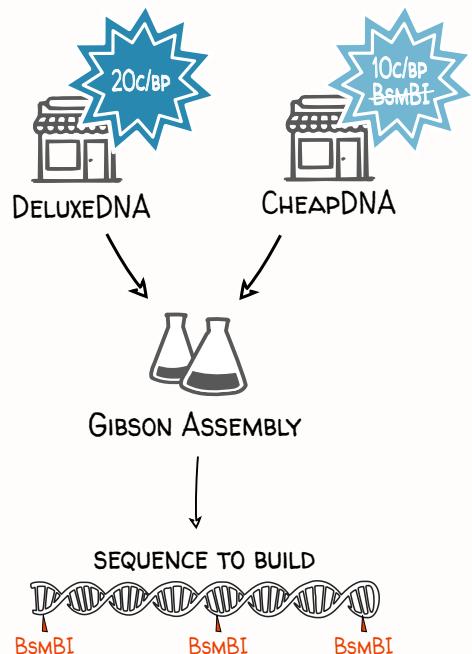


A* RESOLUTION

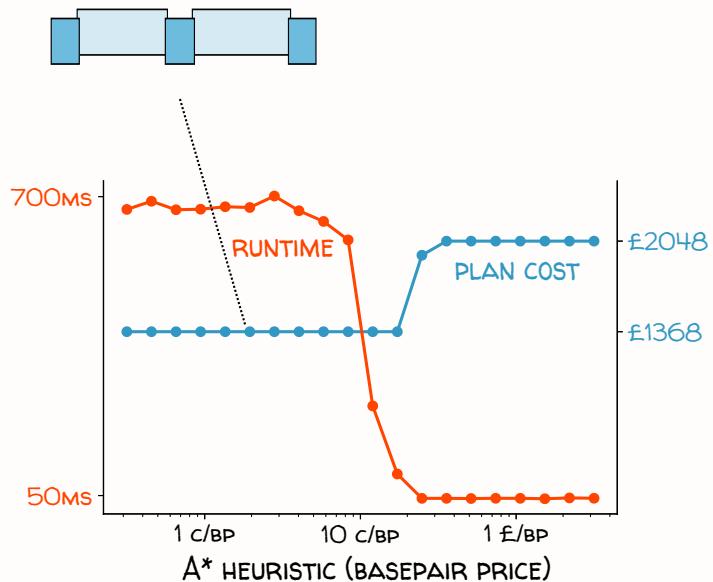


Accelerating sequence decomposition with the A* algorithm

PROBLEM

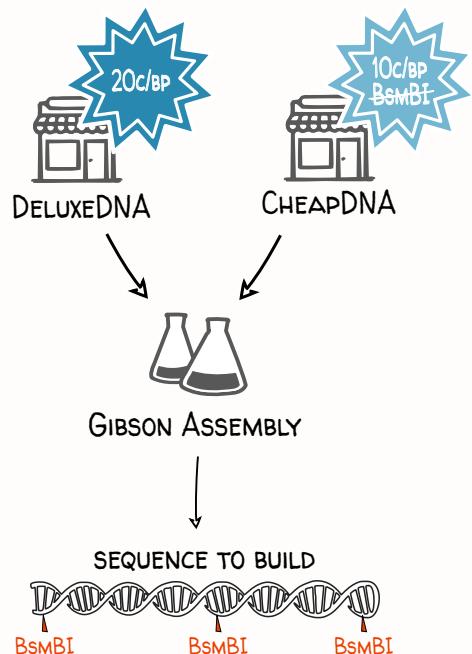


A* RESOLUTION

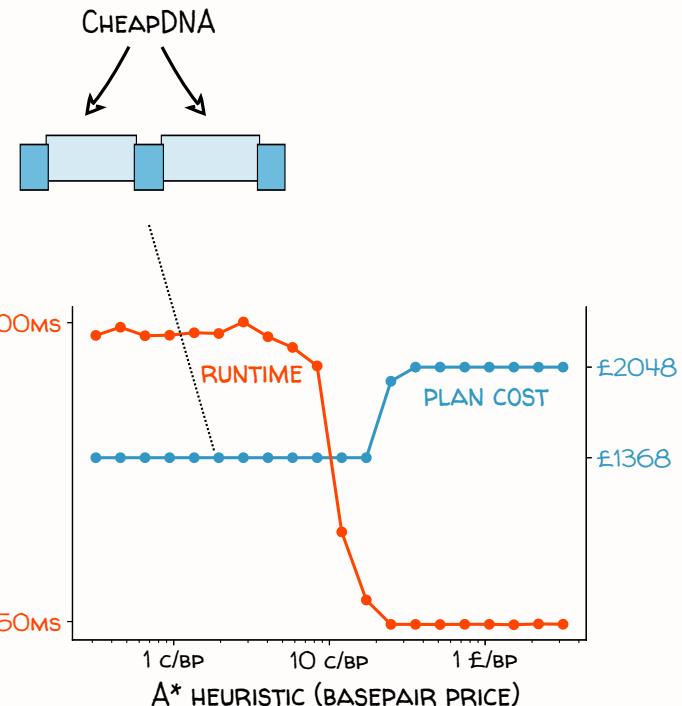


Accelerating sequence decomposition with the A* algorithm

PROBLEM

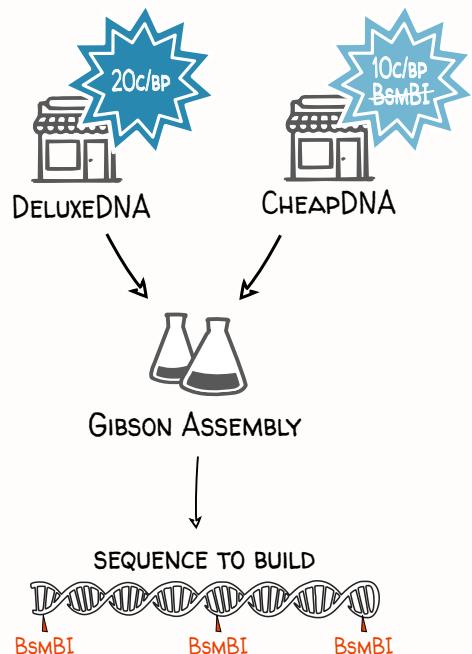


A* RESOLUTION

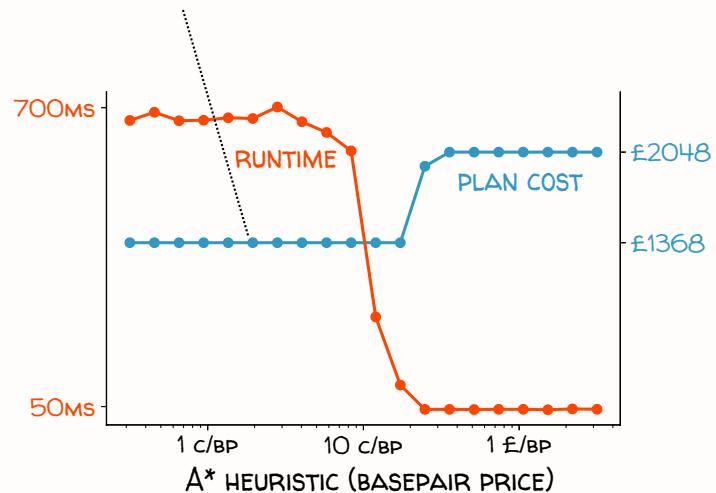
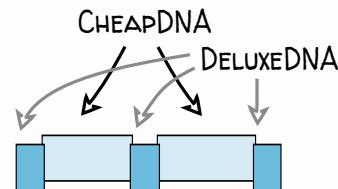


Accelerating sequence decomposition with the A* algorithm

PROBLEM

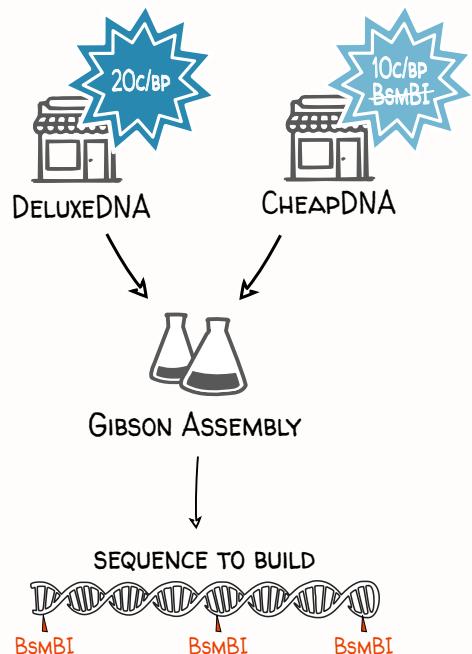


A* RESOLUTION

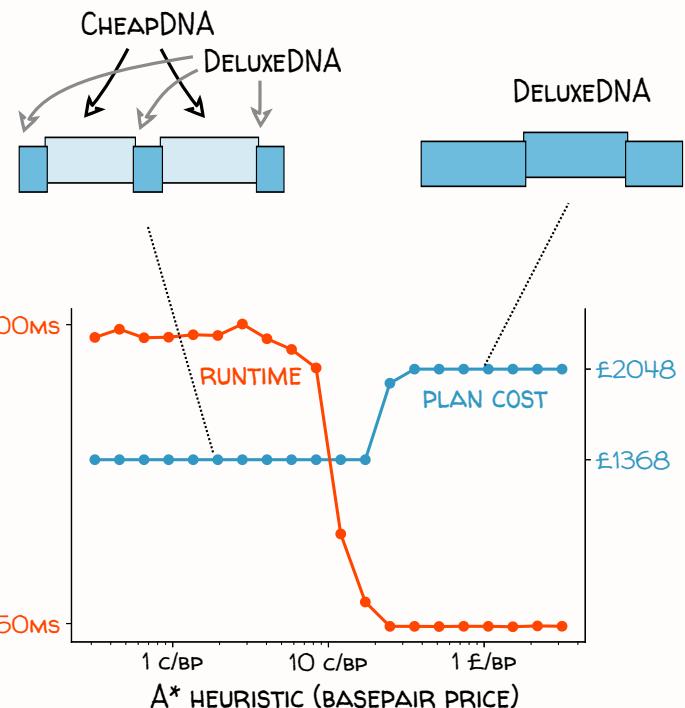


Accelerating sequence decomposition with the A* algorithm

PROBLEM

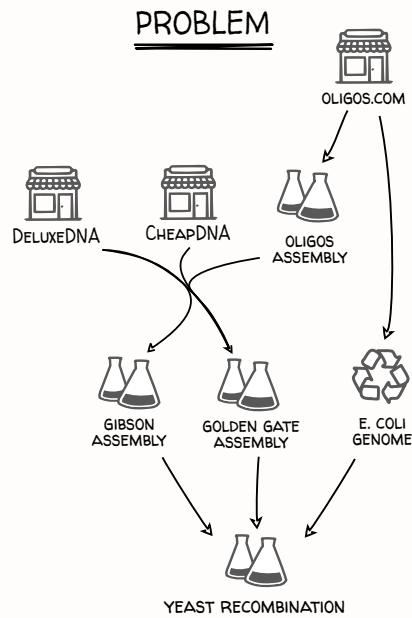


A* RESOLUTION

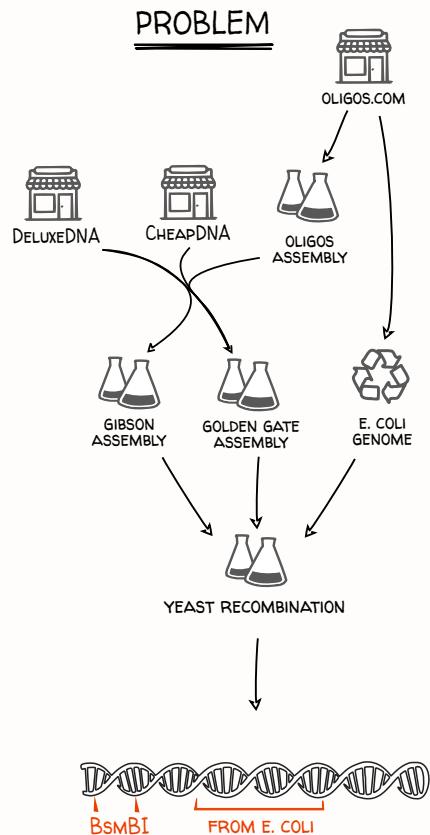


Accelerating sequence decomposition with the A* algorithm

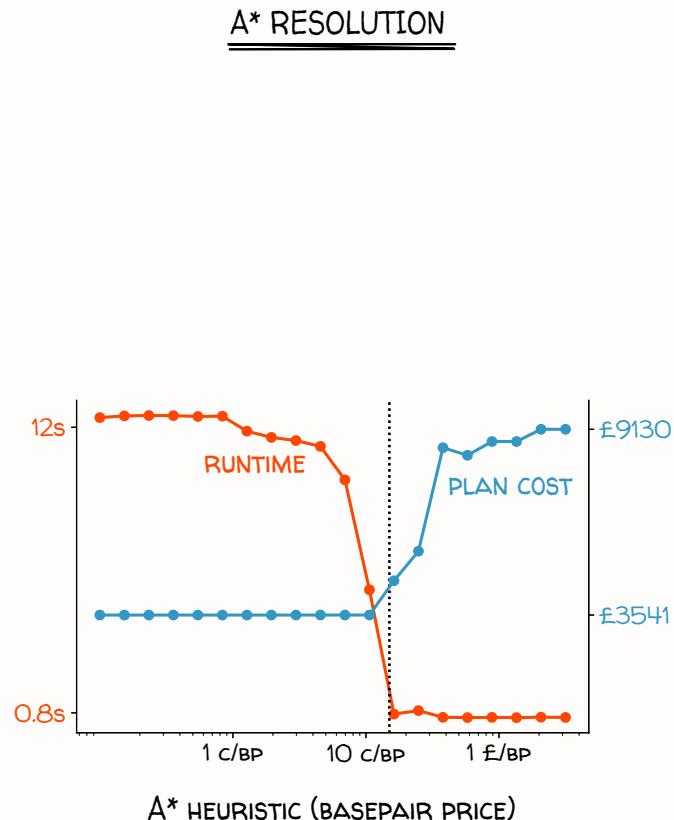
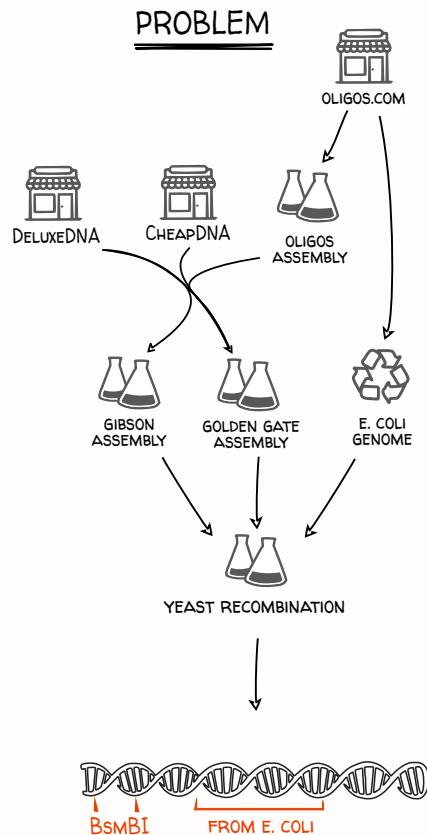
Accelerating sequence decomposition with the A* algorithm



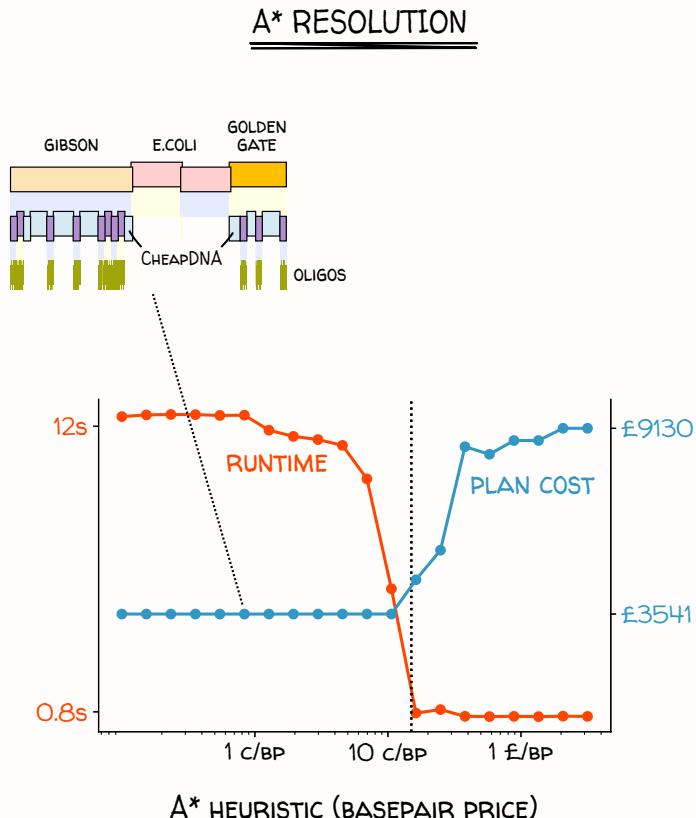
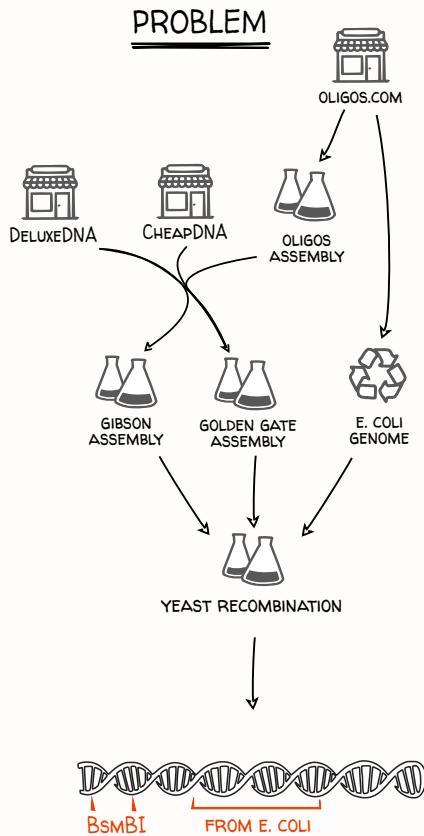
Accelerating sequence decomposition with the A* algorithm



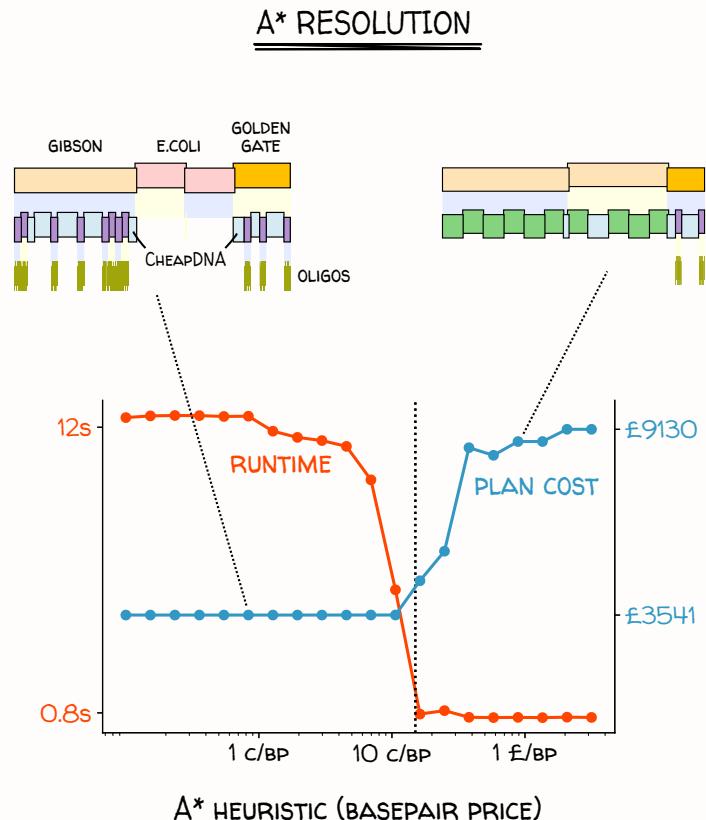
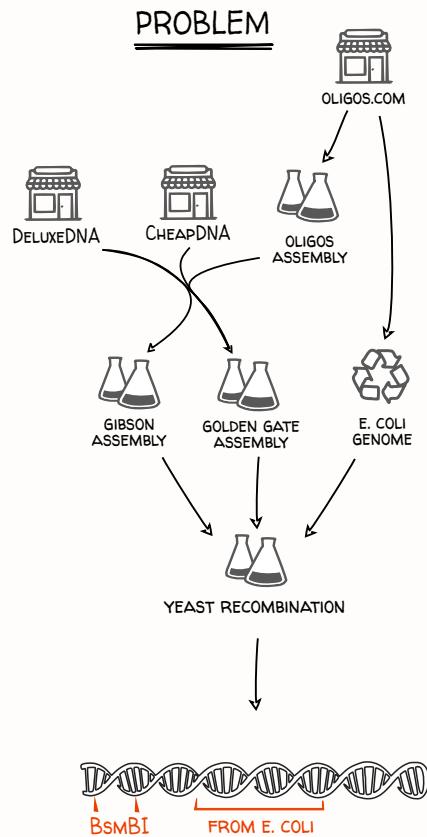
Accelerating sequence decomposition with the A* algorithm



Accelerating sequence decomposition with the A* algorithm

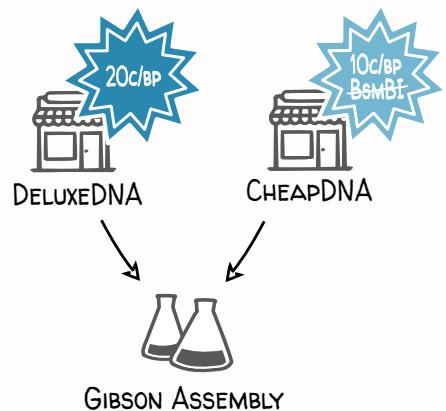


Accelerating sequence decomposition with the A* algorithm

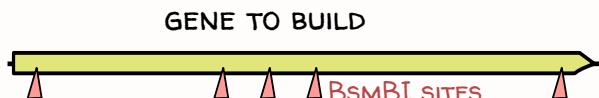
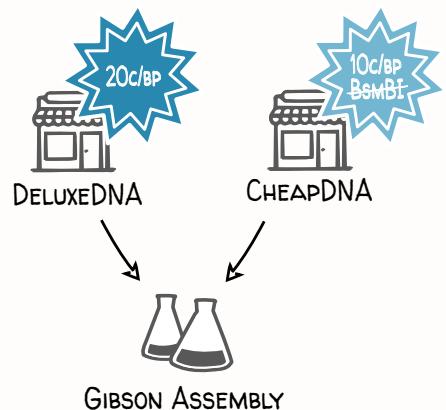


WIP: using DNA Weaver to inform sequence optimization

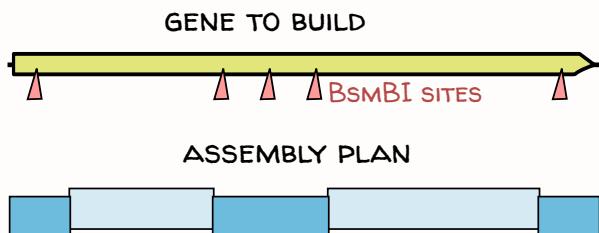
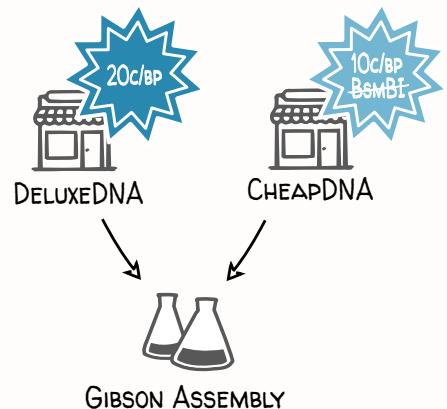
WIP: using DNA Weaver to inform sequence optimization



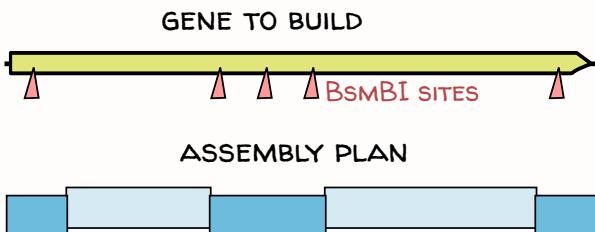
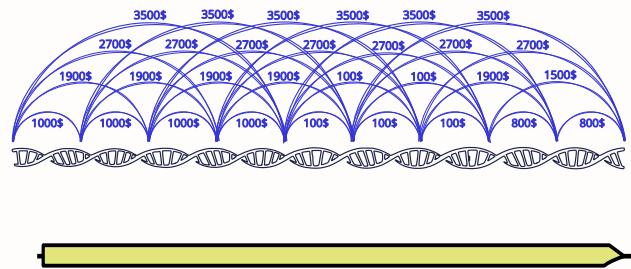
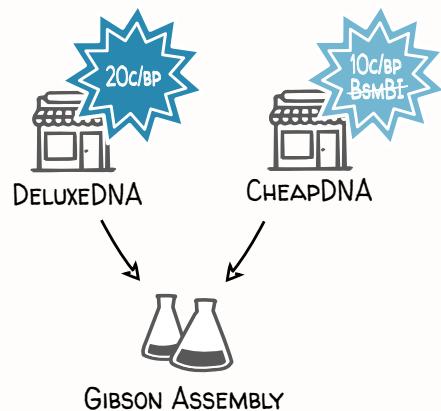
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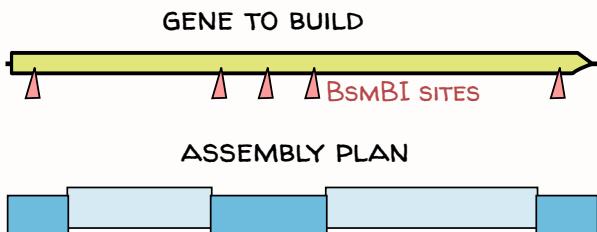
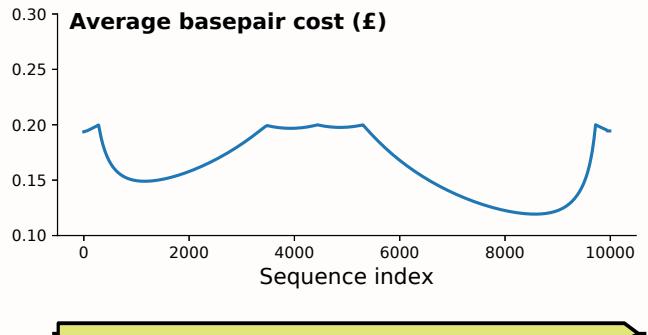
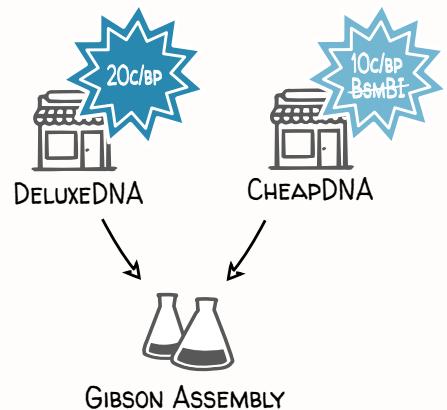
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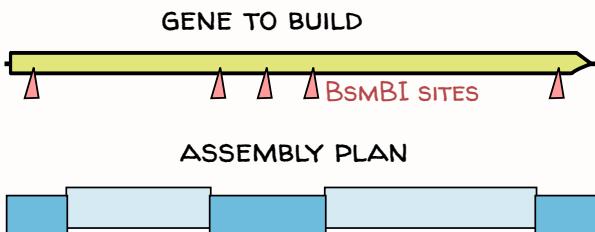
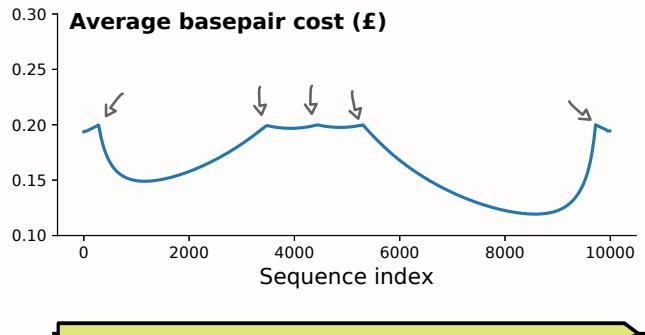
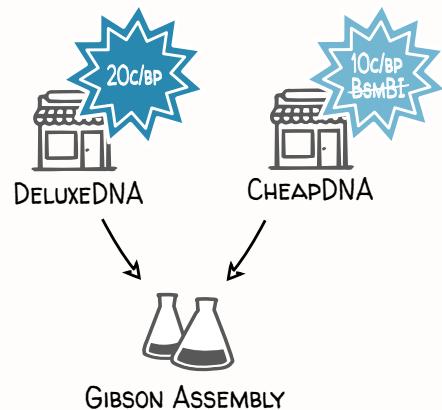
WIP: using DNA Weaver to inform sequence optimization



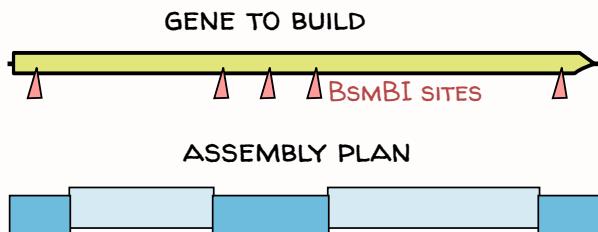
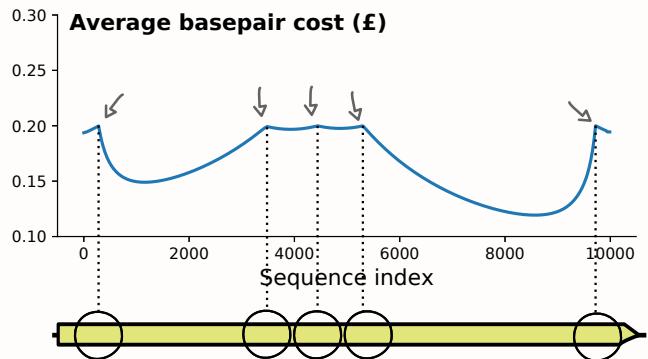
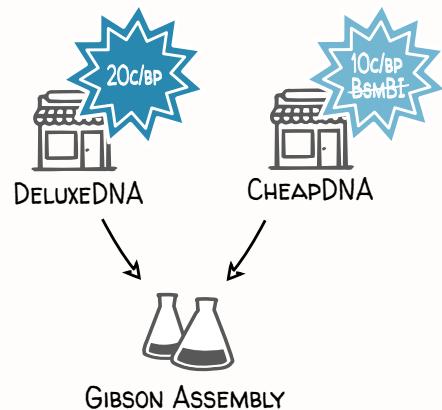
WIP: using DNA Weaver to inform sequence optimization



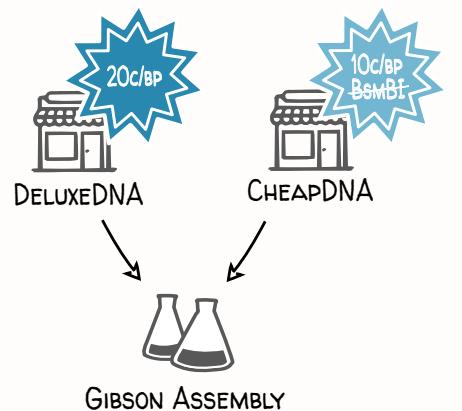
WIP: using DNA Weaver to inform sequence optimization



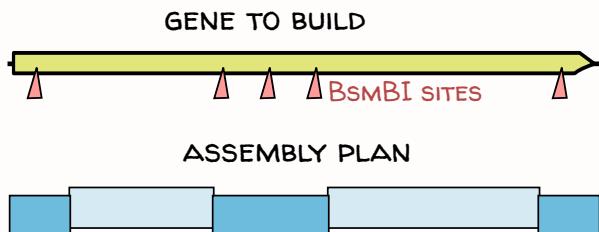
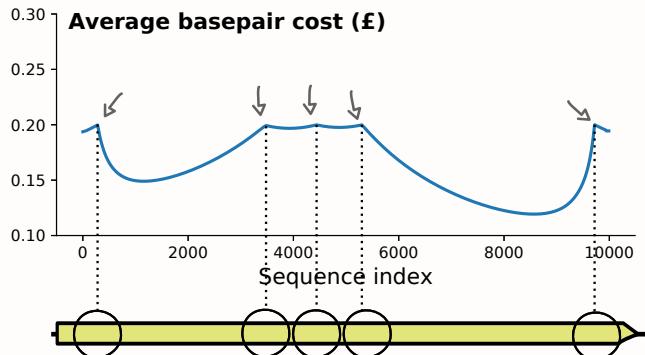
WIP: using DNA Weaver to inform sequence optimization



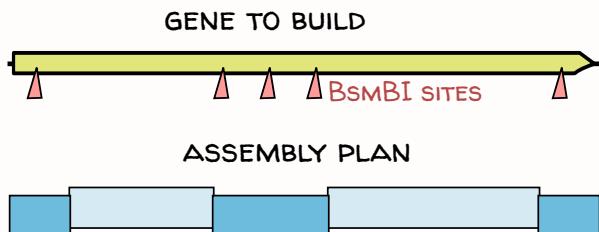
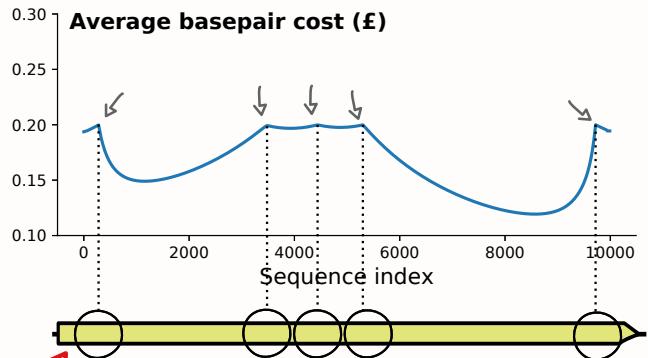
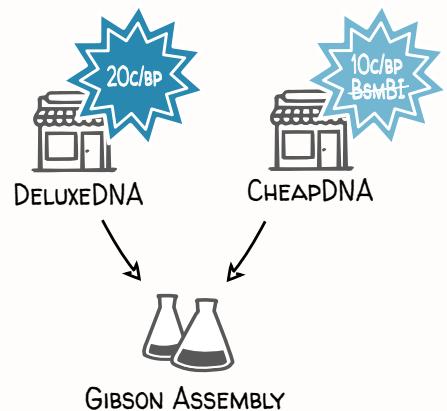
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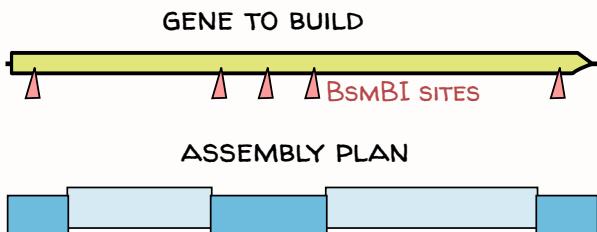
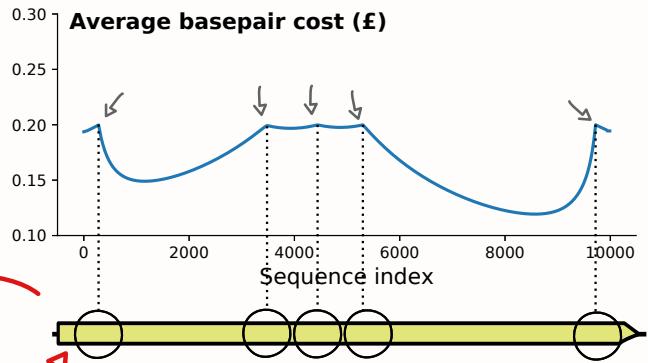
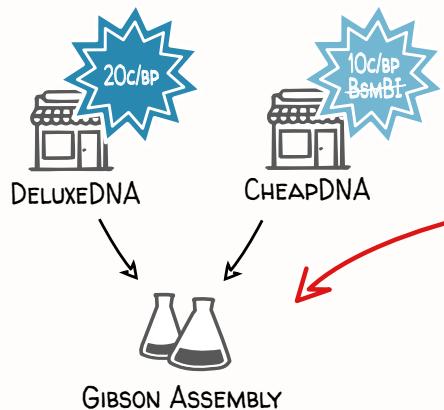
OPTIMIZER



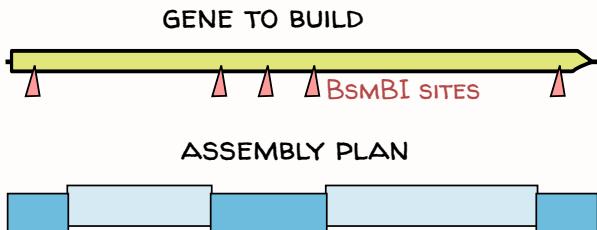
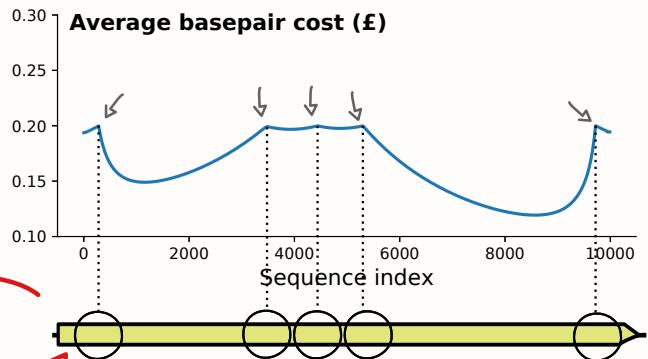
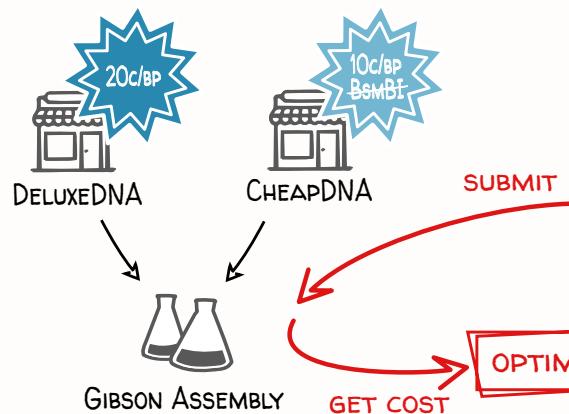
WIP: using DNA Weaver to inform sequence optimization



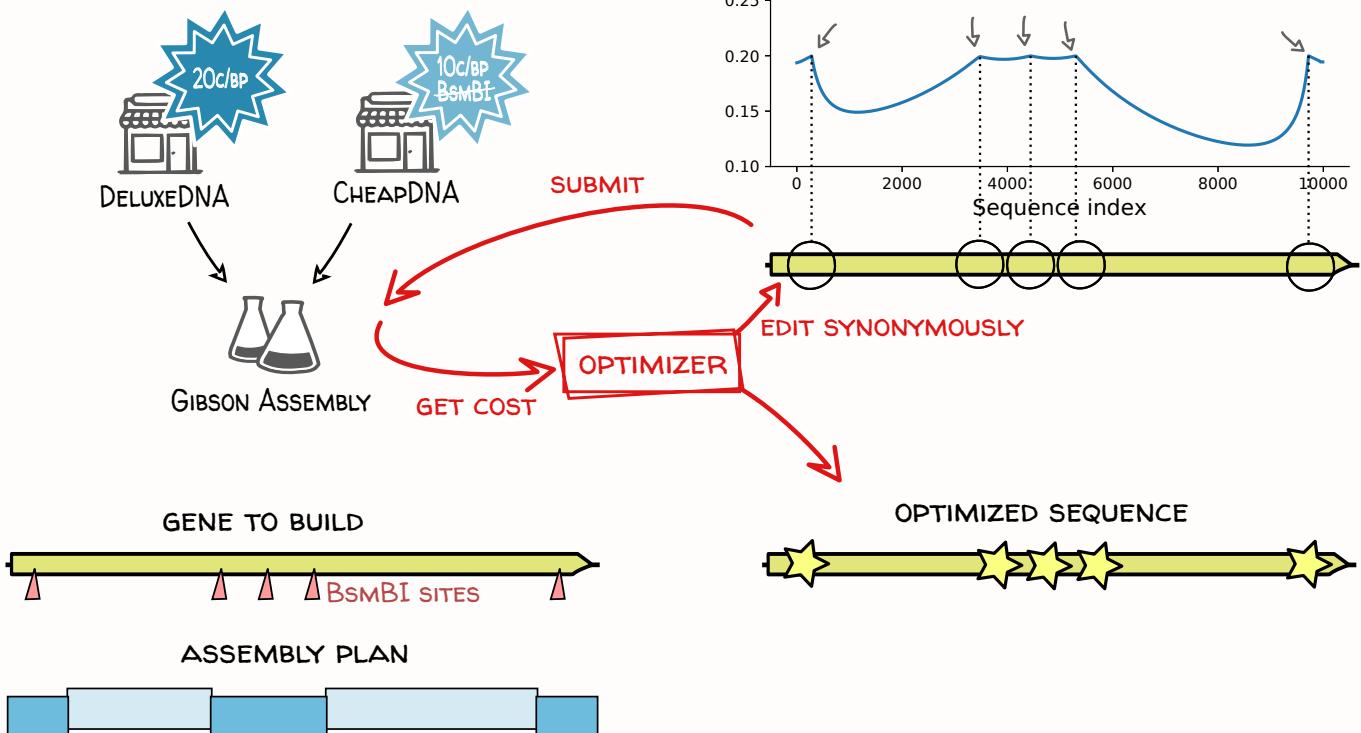
WIP: using DNA Weaver to inform sequence optimization



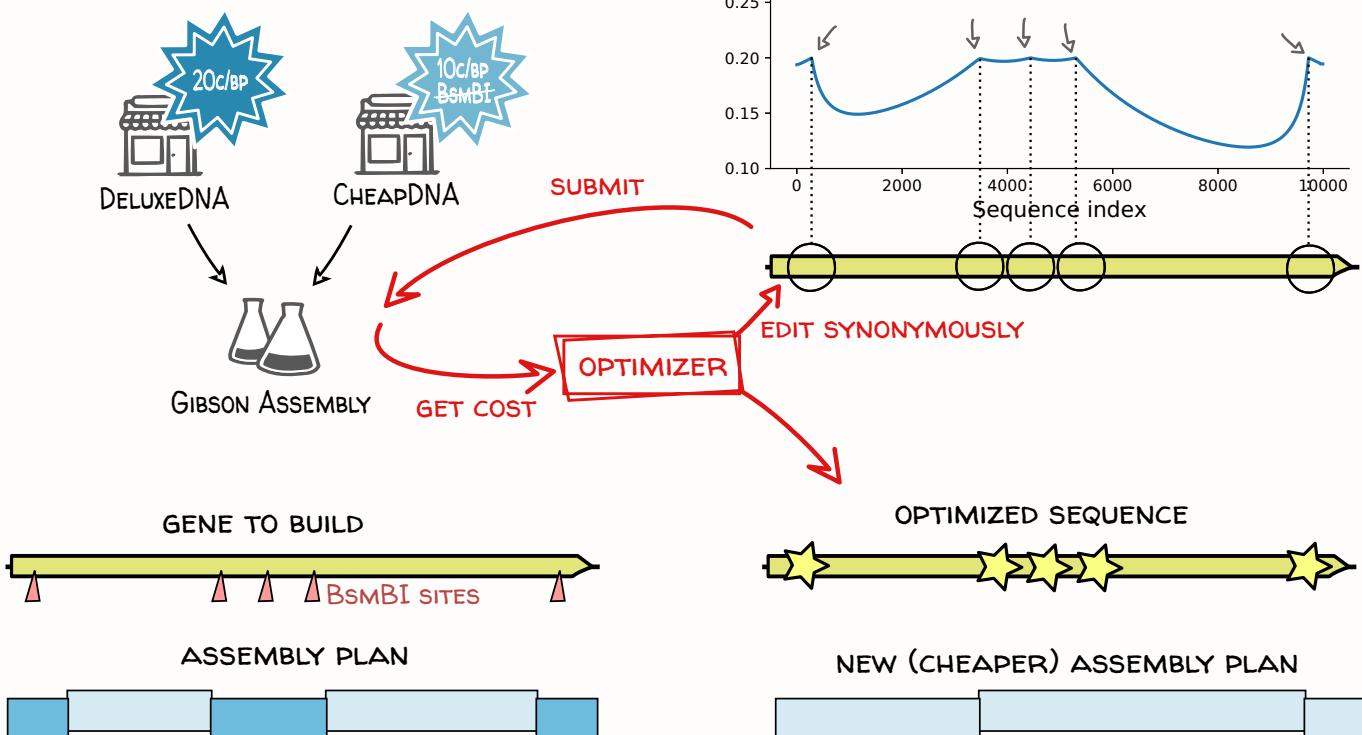
WIP: using DNA Weaver to inform sequence optimization



WIP: using DNA Weaver to inform sequence optimization



WIP: using DNA Weaver to inform sequence optimization



Thanks and see you for your next project!

DIRECTION

Susan Rosser
Founding Co-director



Filippo Melanoscina
Co-Director



Giovanni Stracquadanio
Co-Director



Liz Fletcher
Centre Manager



TEAM

Nick Pantidos
Research Technologist



Scott Neilson
Technician



Valentin Zulkower
Software Manager



ALUMNI

Hille Tekotte
Manager



Aitor Bleda
Integration Engineer



Sarah Zheng
Automation engineer



Ivan Yuan
Technologist



Isaac Luo
Software Engineer



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Jane Paget
Application Scientist



Pascoe Harvey
Technical Expert



Laura Milne
Research Technologist



Anais Moisy
Designer

