

Exploiting Temporal Dynamics in Sybil Defenses

Presented by Patrick Crowe

Motivation

- Paper aims to examine how an attacker can impact and utilize social network connections
- Paper aims to show how an attacker could evade detection or create DoS
- We want to think in terms of the “temporal dynamics” of a social network and optimize our defenses to suit a dynamic network



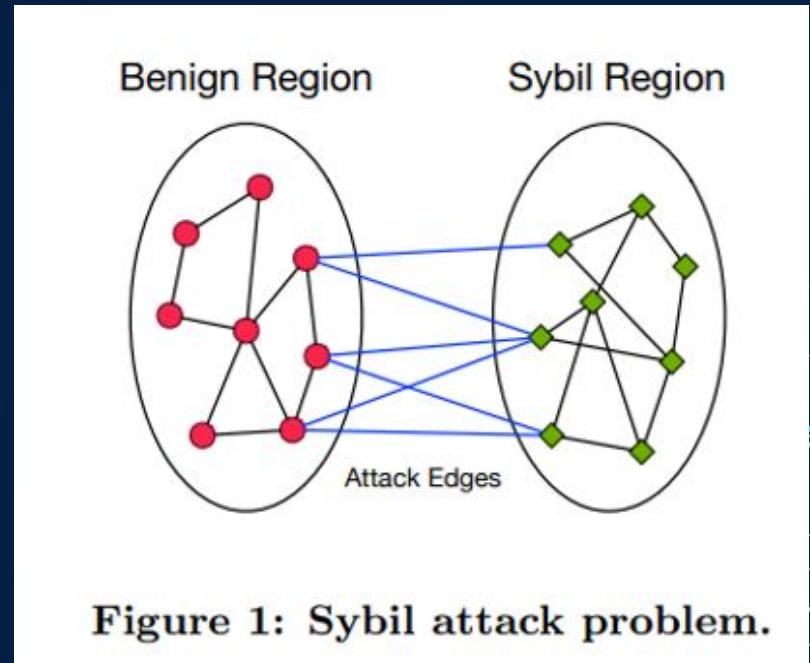
Motivation: Correct Our Assumptions

- Current Sybil protection system based off of a static model
- Previous experiments have assumed that networks are static
- Experiments assume an adversary only conducts an attack at a single moment and not over time



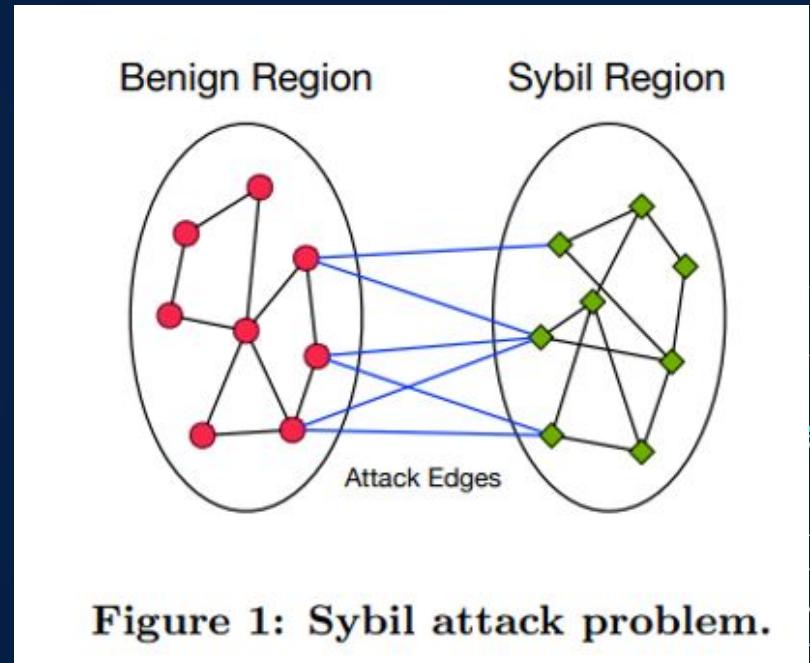
Background

- Tech can make use of democratic systems, but unlike voting in real life, a tech user can maintain multiple identities and control more voting power



Background

- Other approaches, some human verifier like CAPTCHA. Yu et al. approach: leverage social media approach
 - Analyze topology of the graph and identify who is human and who is a bot



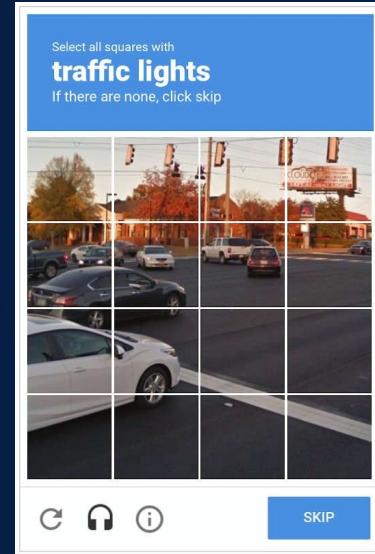
Background

- Possible under the assumption that bots have a limited number of “attack edges”
 - Wrong, studies show users trust sybils more than expected
- Assumes graph is “fast mixing”
 - = graph is “well-connected, giant community of structure of honest users”
 - Wrong, networks are more like small communities rather than a homogeneous mixture



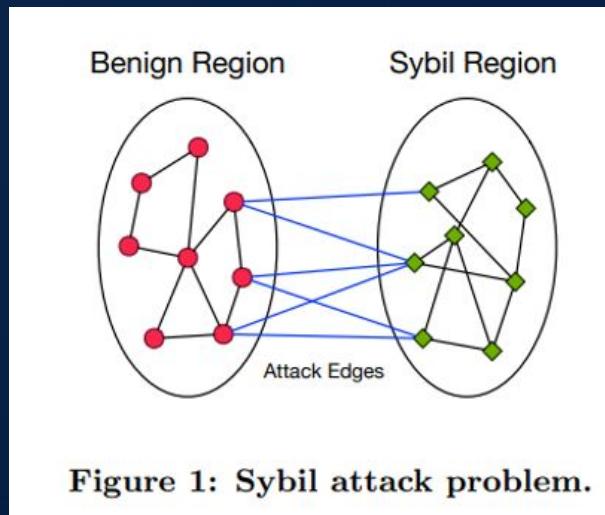
Background

- Thought to be more superior because it is more mathematical than CAPTCHA/human verifier
- Goal: “offer universal sybil defense to all honest nodes in the system”



Methodology

- Three temporal qualities that can be used maliciously
 - Churn in the sybil region
 - Churn in the honest region
 - Churn along the attack edges



Churn in the sybil region

- How: delete nodes and create new ones or break connections and remake them
- Re-registration attack
 - Ensures number of sybil nodes is below detectable threshold
 - Delete blacklisted nodes and replace with new ones
 - Can impact voting by creating a node, voting, deleting the node, and then creating a new one with a new opportunity to vote and start the process over



Churn in the honest region

- How: delete nodes and create new ones or break connections and remake them
- Re-registration attack
 - Ensures number of sybil nodes is below detectable threshold
 - Delete blacklisted nodes and replace with new ones
 - Can impact voting by creating a node, voting, deleting the node, and then creating a new one with a new opportunity to vote and start the process over



Churn in the sybil region

- Examples:
 - SybilLimit
 - Validation is determined by location (flawed but off topic)
 - (think of the number of connections a region has made throughout its history as a valuable resource)
 - Re-registration: Over time, infinitely many sybil identities can be validated by honest nodes, as long as old, validated ones are removed and new ones are situated in their place

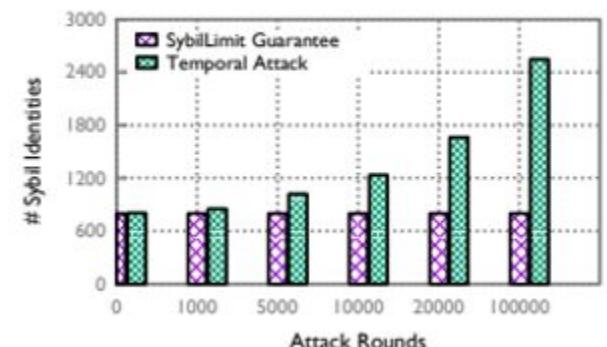
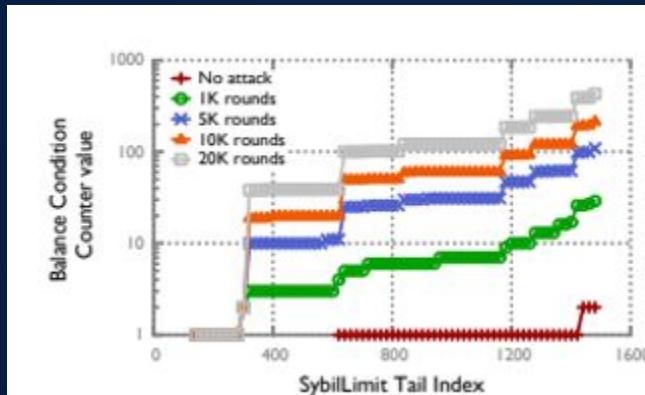
Churn in the sybil region

- Examples:
 - SybilLimit
 - Validation is hindered if a node (attack edge) is used to validate too many other nodes
 - Determined by comparing a node's counter to the average counter value
 - Counter elevation attack: an attacker floods the network with new nodes, and honest nodes must validate the influx of new accounts, raising the average counter value, allowing more sybils to be verified by attack edges



Churn in the sybil region

- Examples:
 - SybilLimit
 - Because the counter of validations is unbounded, the number of verifications an attacker can have at an attack edge is unbounded



Are we done?

- Current Sybil protection system based off of a static model



Research Quality

- **Versus SoK: The Evolution of Sybil Defense via Social Networks,**
L Alvisi, A Clement, A Epasto, S Lattanzi, A Panconesi S&P 2013
- Could have done better in background
- Very thorough in explaining vulnerabilities in specific software
 - Scope of software is limited
 - Still left wondering if these are widely used software products or generalizable solutions



ANNOUNCEMENTS

Here you could describe the topic
of the section

IN DEPTH

Here you could describe the topic
of the section

IN BRIEF

Here you could describe the topic
of the section

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WELCOME!

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of the section

EVENTS

Here you could describe the topic
of the section

SNEAK PEEK

Here you could describe the topic
of the section



01

ANNOUNCEMENTS

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1st ANNOUNCEMENT



Mercury is the closest planet to the Sun and the smallest one in the Solar System—it's only a bit larger than our Moon. The planet's name has nothing to do with the liquid metal, since it was named after the Roman messenger god, Mercury

2nd ANNOUNCEMENT

MARS

Despite being red,
Mars is a cold place,
not hot

NEPTUNE

Neptune is the farthest planet from the Sun, the fourth-largest in our Solar System

JUPITER

It's a gas giant and the biggest planet in our Solar System

SATURN

Saturn is a gas giant, composed of hydrogen and helium



The background features a complex network of cyan-colored dots connected by thin white lines, forming numerous triangles of varying sizes. This pattern is dense on the left side of the slide and more sparse on the right, creating a sense of depth and movement.

02

IN DEPTH

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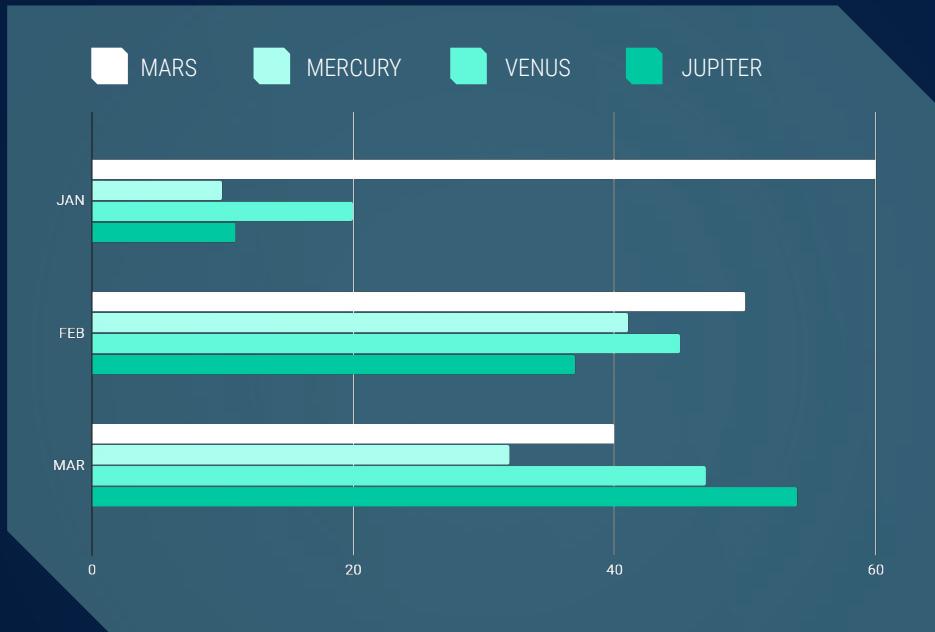
IN DEPTH

MERCURY

Mercury is the closest planet to the Sun and the smallest one in the Solar System—it's only a bit larger than our Moon. The planet's name has nothing to do with the liquid metal, since it was named after the Roman messenger god, Mercury



IN DEPTH



If you want to modify these graphs, click on them, follow the link, change the data and replace them

VENUS

Venus has a beautiful name and is the second planet from the Sun. It's terribly hot—even hotter than Mercury—and its atmosphere is extremely poisonous. It's the second-brightest natural object in the night sky after the Moon



OUR NUMBERS

500

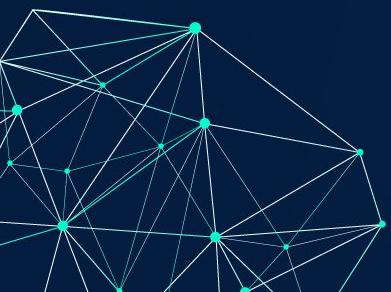
new clients last semester

100

ongoing projects

40

new employees last semester



SECTOR NEWS



VENUS

Venus has a beautiful name and is the second planet from the Sun. It's terribly hot, even hotter than Mercury

Despite being red, Mars is a cold place, not hot. It's full of iron oxide dust, which gives the planet its reddish cast

MARS



SATURN

Yes, this is the ringed one. It's a gas giant, composed mostly of hydrogen and helium. It's named after the Roman god of wealth and agriculture

03

IN BRIEF

You can enter here the subtitle if you need it

NEWS



NEPTUNE

Neptune is the farthest planet from the Sun and the fourth-largest in our Solar System



MARS

Despite being red, Mars is a cold place, not hot. It's full of iron oxide dust, which gives the planet its reddish cast



MERCURY

Mercury is the closest planet to the Sun and also the smallest one in our Solar System



JUPITER

Jupiter is the biggest planet in our Solar System and also the fourth-brightest object in the sky



VENUS

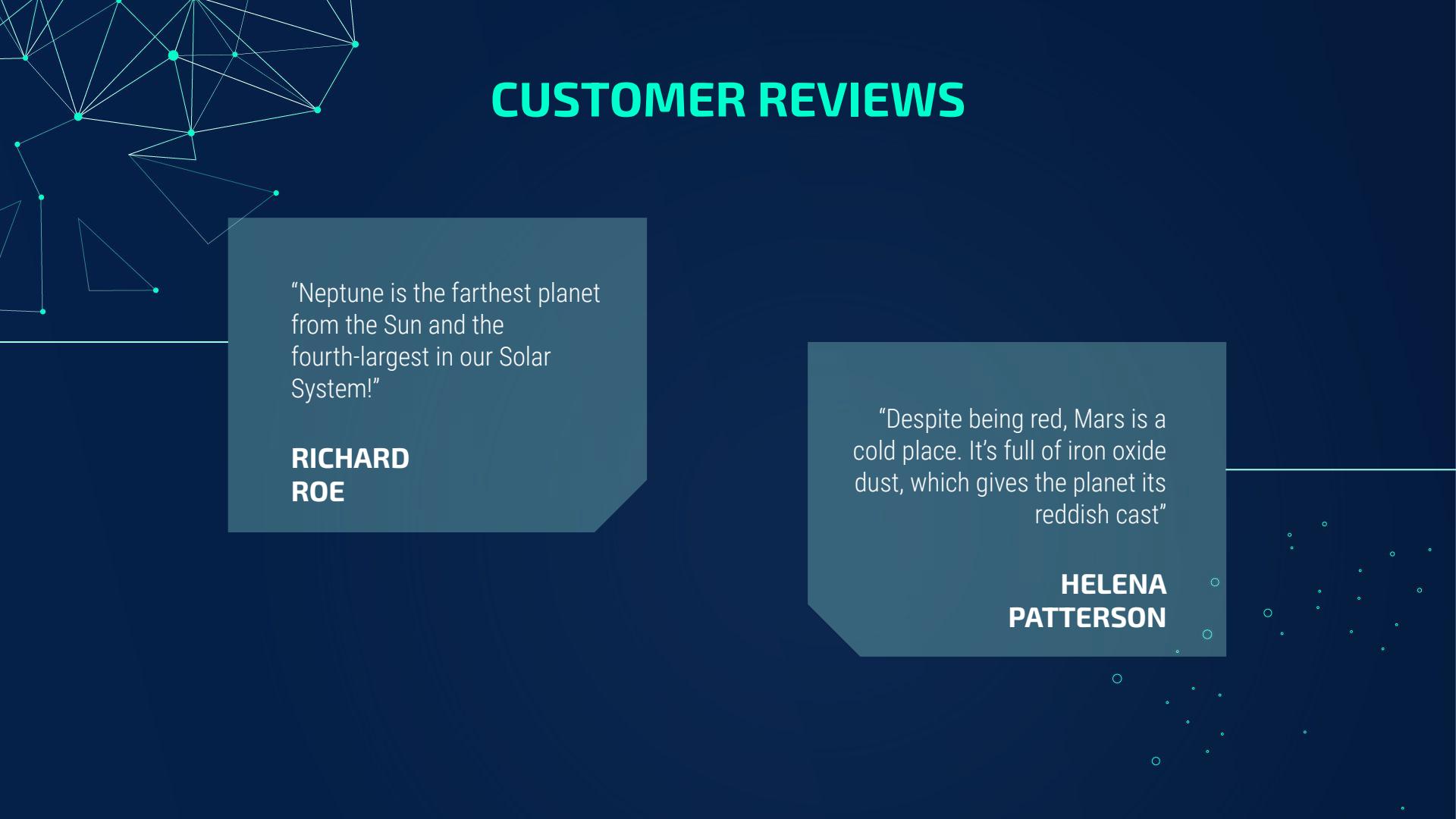
Venus has a beautiful name and is the second planet from the Sun. It's terribly hot, even hotter than Mercury



SATURN

Saturn is the ringed planet. It's a gas giant, composed mostly of hydrogen and helium





CUSTOMER REVIEWS

"Neptune is the farthest planet from the Sun and the fourth-largest in our Solar System!"

**RICHARD
ROE**

"Despite being red, Mars is a cold place. It's full of iron oxide dust, which gives the planet its reddish cast"

**HELENA
PATTERSON**

TABLE

	ISSUE 1	ISSUE 2	ISSUE 3	ISSUE 4
VENUS	12	32	23	45
MERCURY	67	23	45	65
MARS	67	49	78	34



04

WELCOME!

You can enter here the subtitle if you need it



WELCOME!



MARY RUIZ

Neptune is the farthest planet from the Sun and the fourth-largest in our Solar System



JONATHAN DOE

Mercury is the closest planet to the Sun and the smallest one in our Solar System

JOHN SMITH

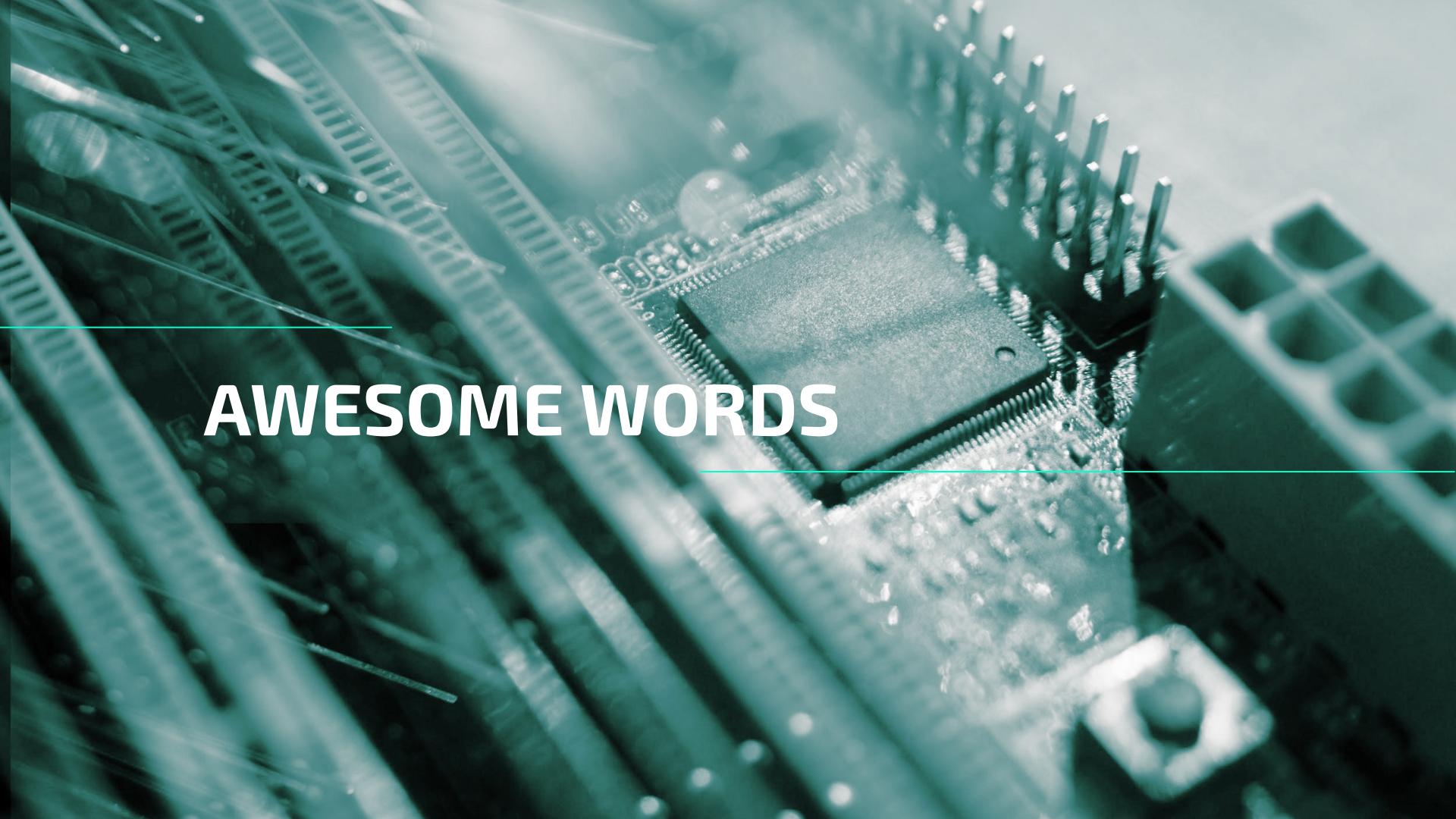
Despite being red, Mars is a cold place, not hot. It's full of iron oxide dust, which gives the planet its reddish cast



MINA HAWKINS

Venus has a beautiful name and is the second planet from the Sun. It's terribly hot, even hotter than Mercury





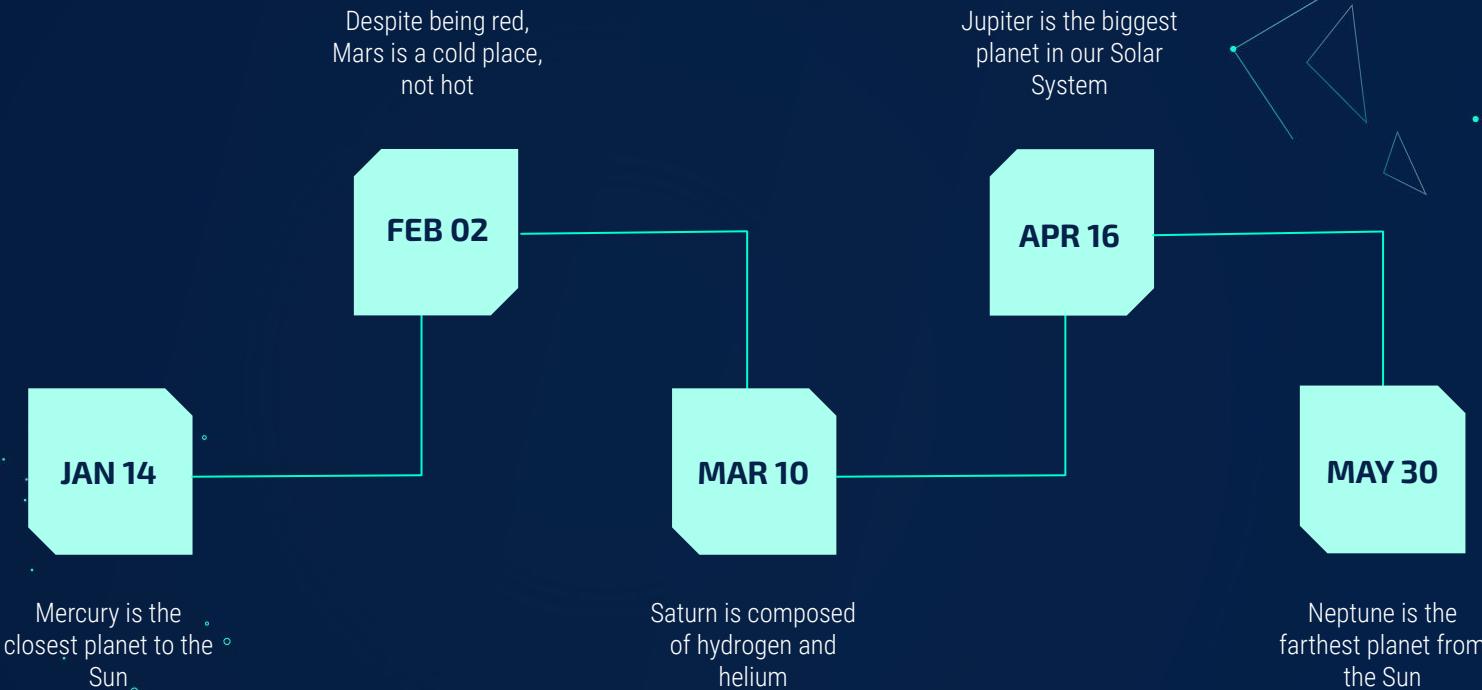
AWESOME WORDS

05

EVENTS

You can enter here the subtitle if you need it

REVIEW OF PAST EVENTS



UPCOMING EVENTS

SEP 08

Mercury is the closest planet to the Sun



OCT 16

Despite being red, Mars is a cold place, not hot



NOV 29

Saturn is composed of hydrogen and helium



DEC 10

Jupiter is the biggest planet in our Solar System

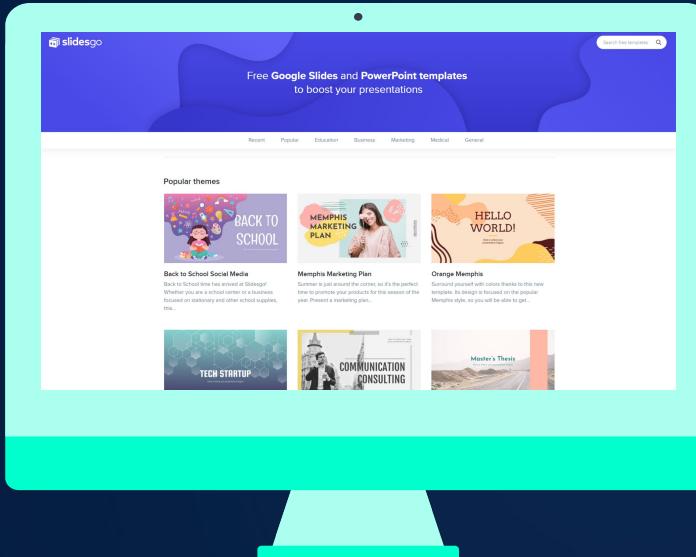
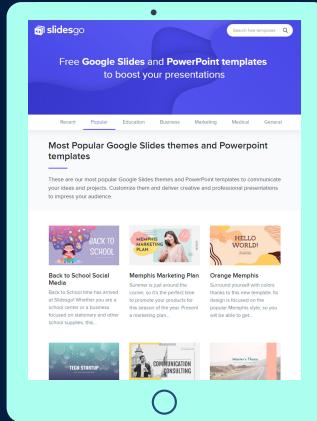


06

SNEAK PEEK

You can enter here the subtitle if you need it

SNEAK PEEK



Neptune is the farthest planet from the Sun and the fourth-largest in our Solar System



THANKS

Does anyone have any questions?

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- Woman using smartphone with hologram
- Happy businesswoman looking at camera with holding pencil and diary
- Portrait of smiling man holding digital tablet looking at camera
- Smiling bearded man holding disposable coffee cup while opening door
- Portrait of pretty woman holding laptop looking at camera
- Motherboard with optical fiber



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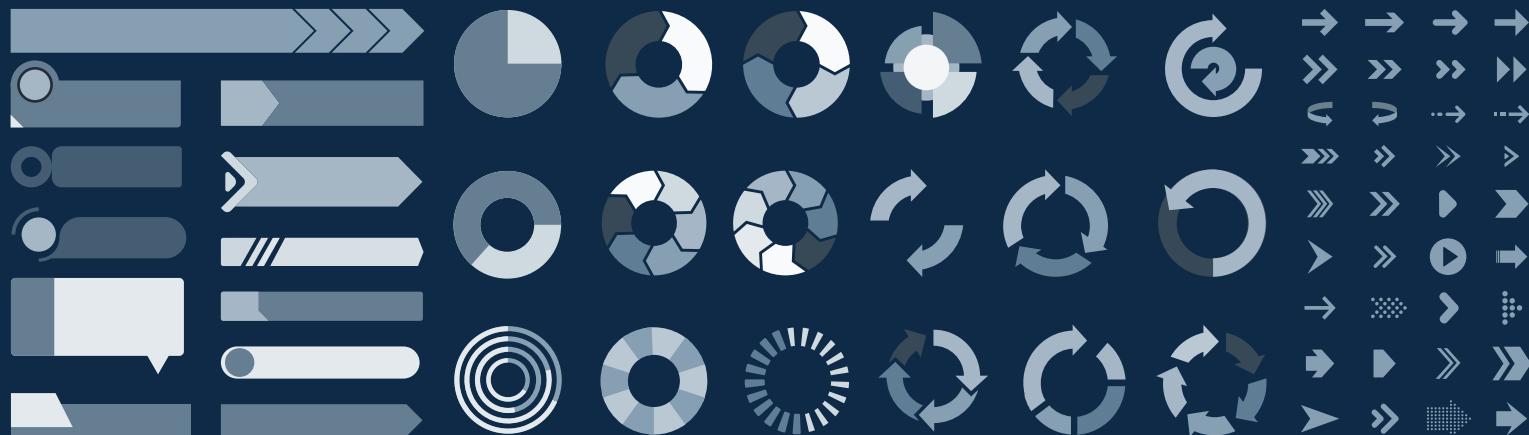
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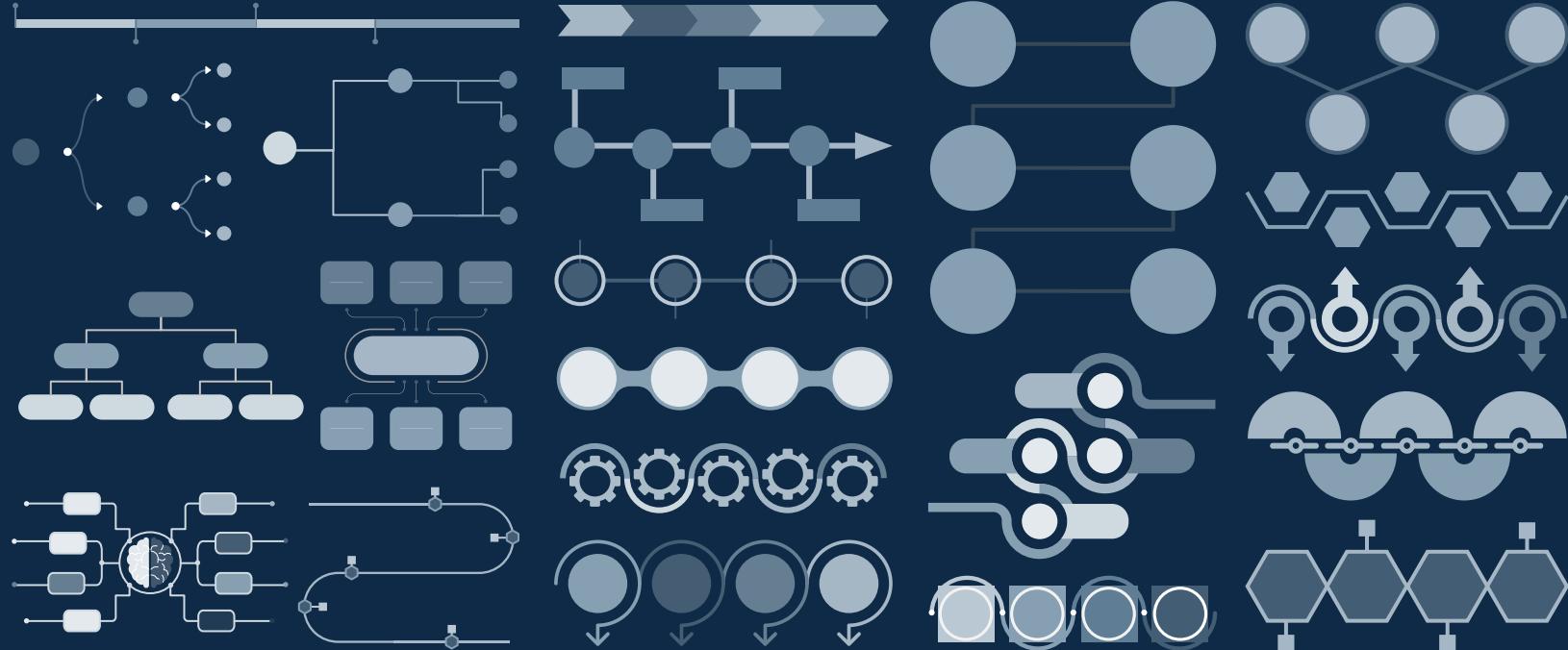
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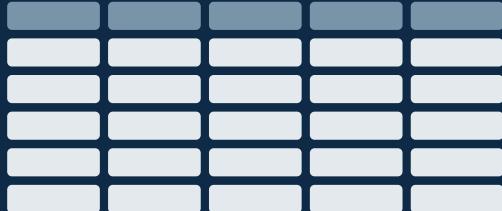
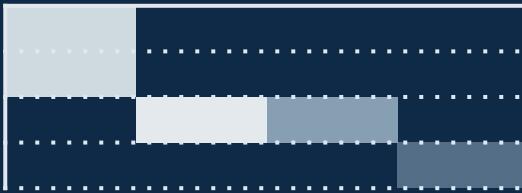
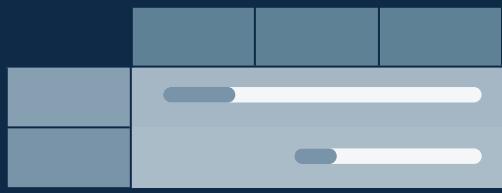
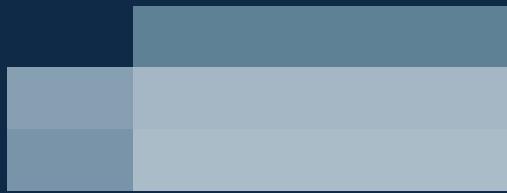
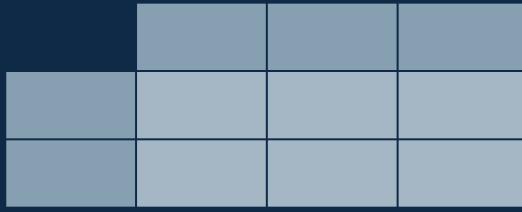
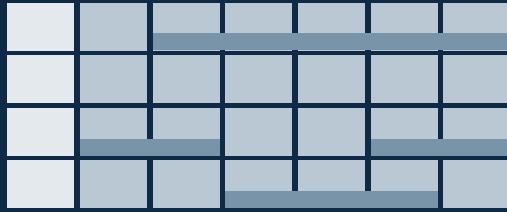
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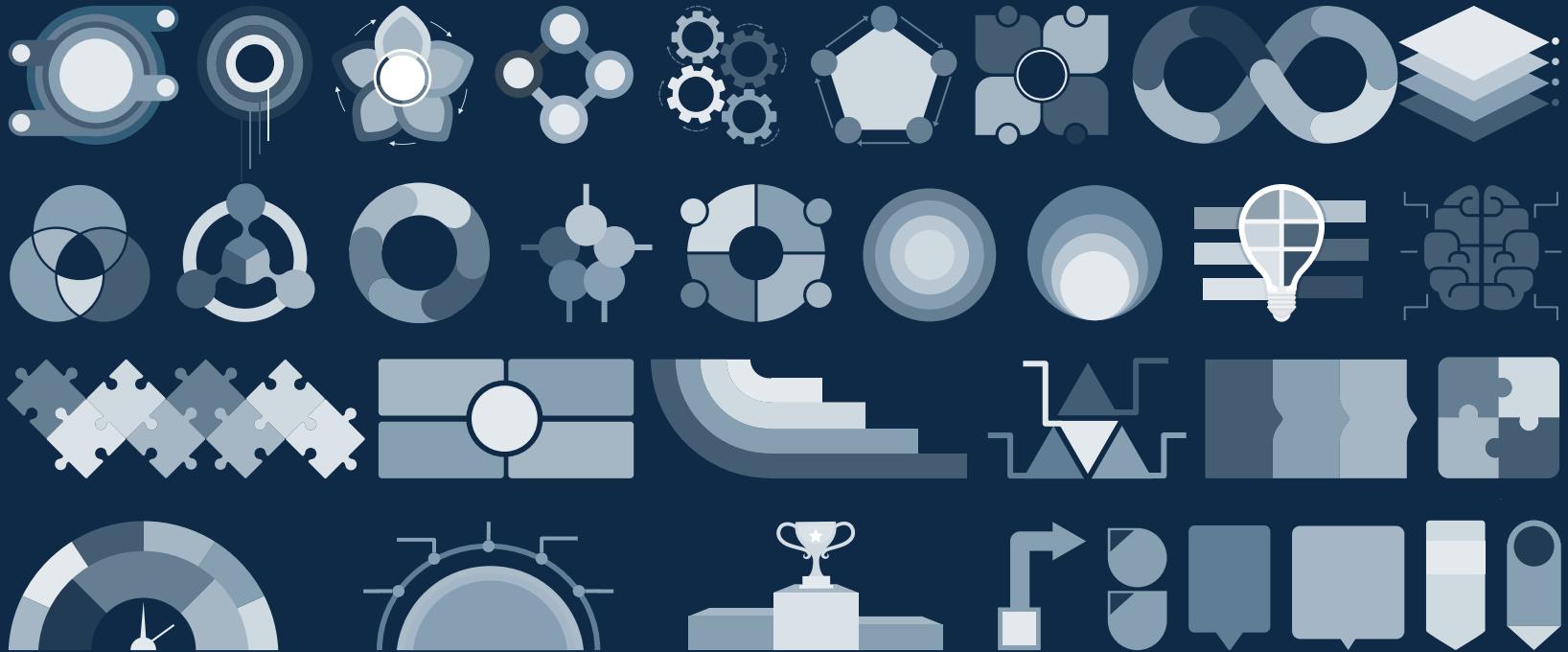
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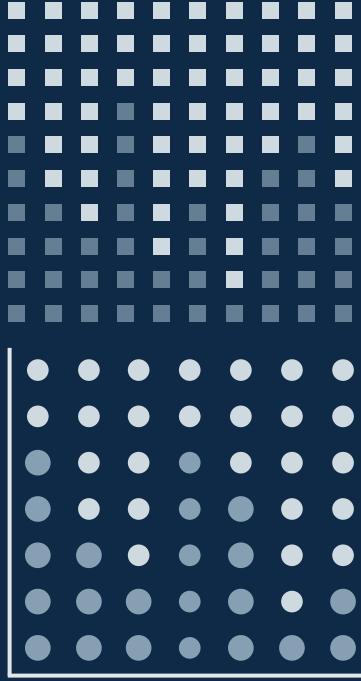












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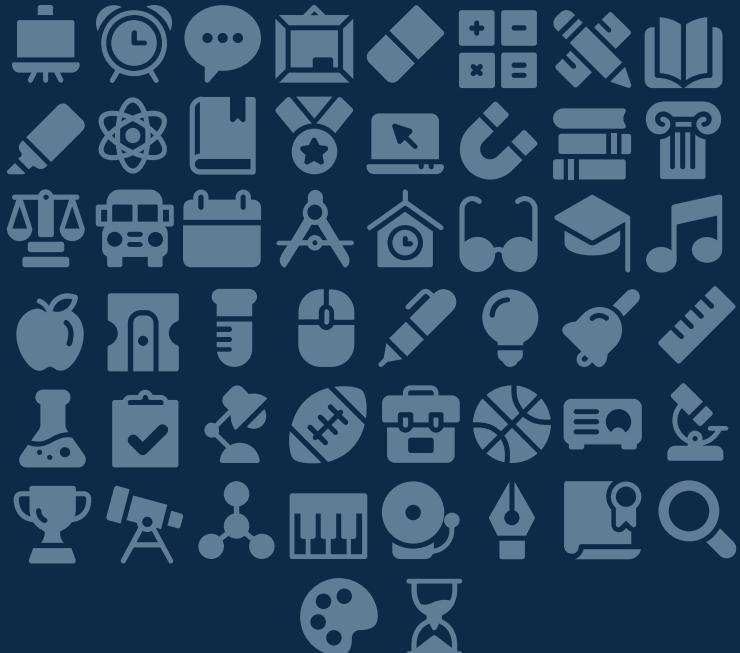
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