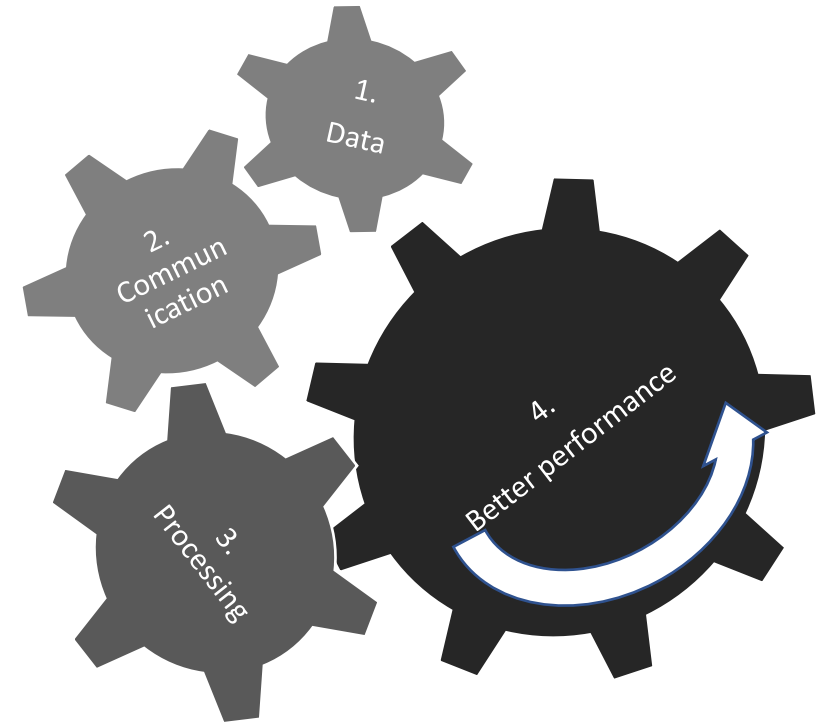


Advanced Digital Systems

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ADVANCED DIGITAL SYSTEMS

What they do, how they work & their crucial role in shipping's strategy for global cargo transport & emissions



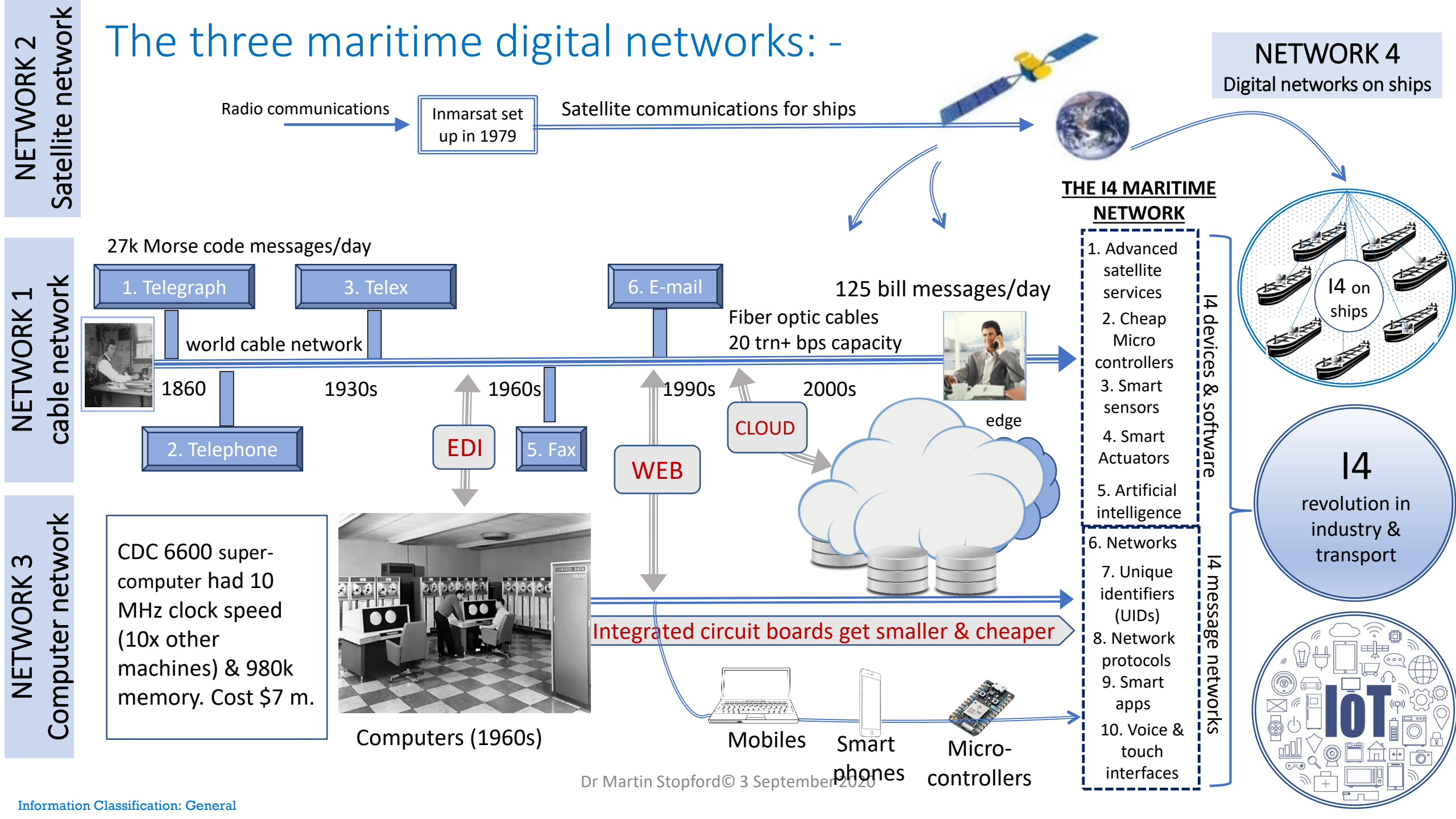
1. The three maritime digital networks
2. Using digital networks to revolutionise ship performance
3. The key role of satellite communication networks
4. Conclusions



1. The three maritime digital networks

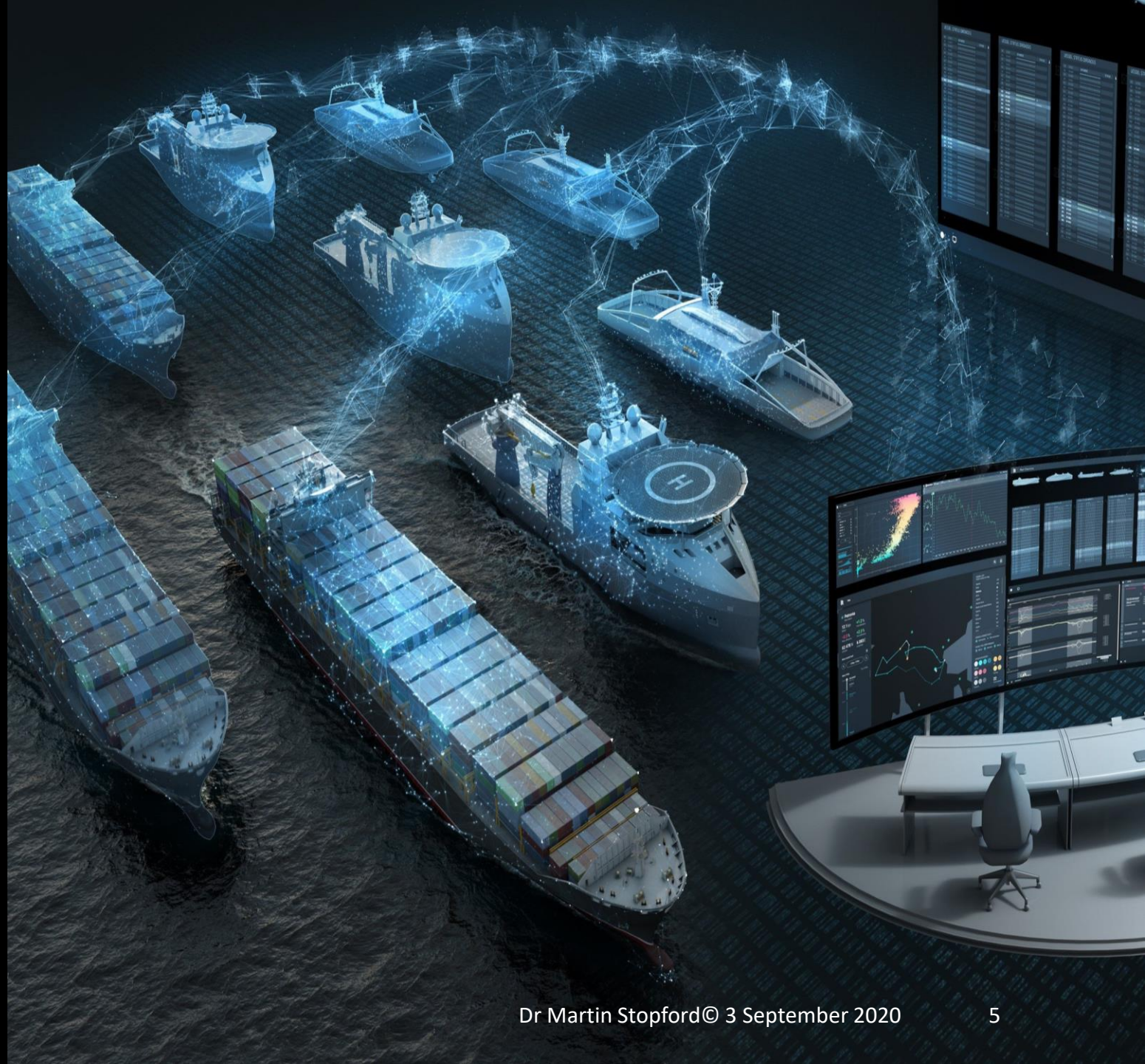
- ✓ There are three digital networks the maritime industry uses today .
- ✓ We are starting to add a fourth – advanced digital networks on board ship

The three maritime digital networks: -



2. Using Digital Networks to Revolutionise Ship Performance

- ✓ Digital networks are the stepping-stones to launching the **maritime I4 revolution**.
- ✓ They are the only way to manage the complex on-board systems needed.



1. Computers communicate with DIGITAL data (binary strings).
2. Smart ship will have many *computer devices* sending messages to each other.
3. Any device receiving a message must know **how it is encoded.**

USASCII code chart

| Bits | | | | | Column | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----------------|----------------|----------------|----------------|----------------|--------|-----|-----|----|---|---|---|---|-----|
| b ₇ | b ₆ | b ₅ | b ₄ | b ₃ | Row | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0 | 0 | 0 | 0 | 0 | 0 | NUL | DLE | SP | 0 | @ | P | ` | p |
| 0 | 0 | 0 | 0 | 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 0 | 0 | 0 | 1 | 0 | 2 | STX | DC2 | " | 2 | B | R | b | r |
| 0 | 0 | 1 | 1 | 0 | 3 | ETX | DC3 | # | 3 | C | S | c | s |
| 0 | 1 | 0 | 0 | 0 | 4 | EOT | DC4 | \$ | 4 | D | T | d | t |
| 0 | 1 | 0 | 1 | 0 | 5 | ENQ | NAK | % | 5 | E | U | e | u |
| 0 | 1 | 1 | 0 | 0 | 6 | ACK | SYN | & | 6 | F | V | f | v |
| 0 | 1 | 1 | 1 | 0 | 7 | BEL | ETB | ' | 7 | G | W | g | w |
| 1 | 0 | 0 | 0 | 0 | 8 | BS | CAN | (| 8 | H | X | h | x |
| 1 | 0 | 0 | 0 | 1 | 9 | HT | EM |) | 9 | I | Y | i | y |
| 1 | 0 | 0 | 1 | 0 | 10 | LF | SUB | * | : | J | Z | j | z |
| 1 | 0 | 1 | 1 | 0 | 11 | VT | ESC | + | ; | K | [| k | { |
| 1 | 1 | 0 | 0 | 0 | 12 | FF | FS | , | < | L | \ | l | |
| 1 | 1 | 0 | 0 | 1 | 13 | CR | GS | - | = | M |] | m | } |
| 1 | 1 | 0 | 1 | 0 | 14 | SO | RS | . | > | N | ^ | n | ~ |
| 1 | 1 | 1 | 1 | 0 | 15 | SI | US | / | ? | O | _ | o | DEL |



Smart valve reads 5 (fully open) and sends digital message "5" in ascii digital code

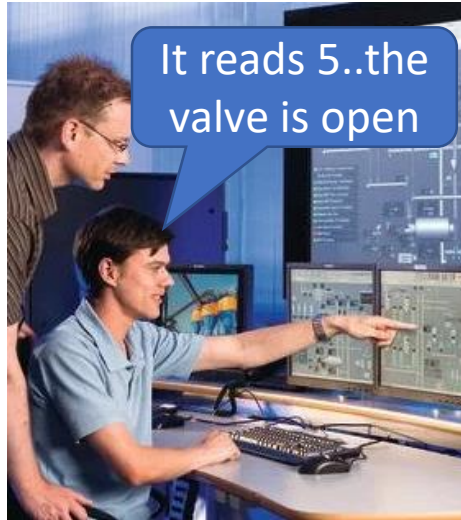
ascii 1010 110

send

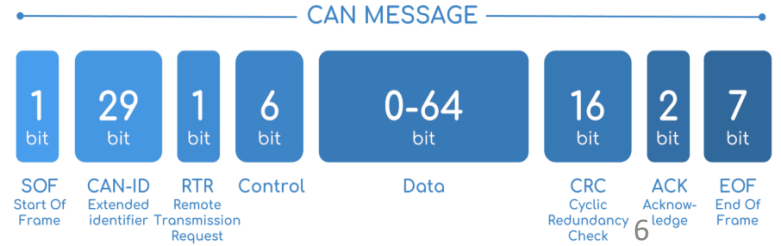
digital network

receive

ascii 1010 110



Format of typical network message

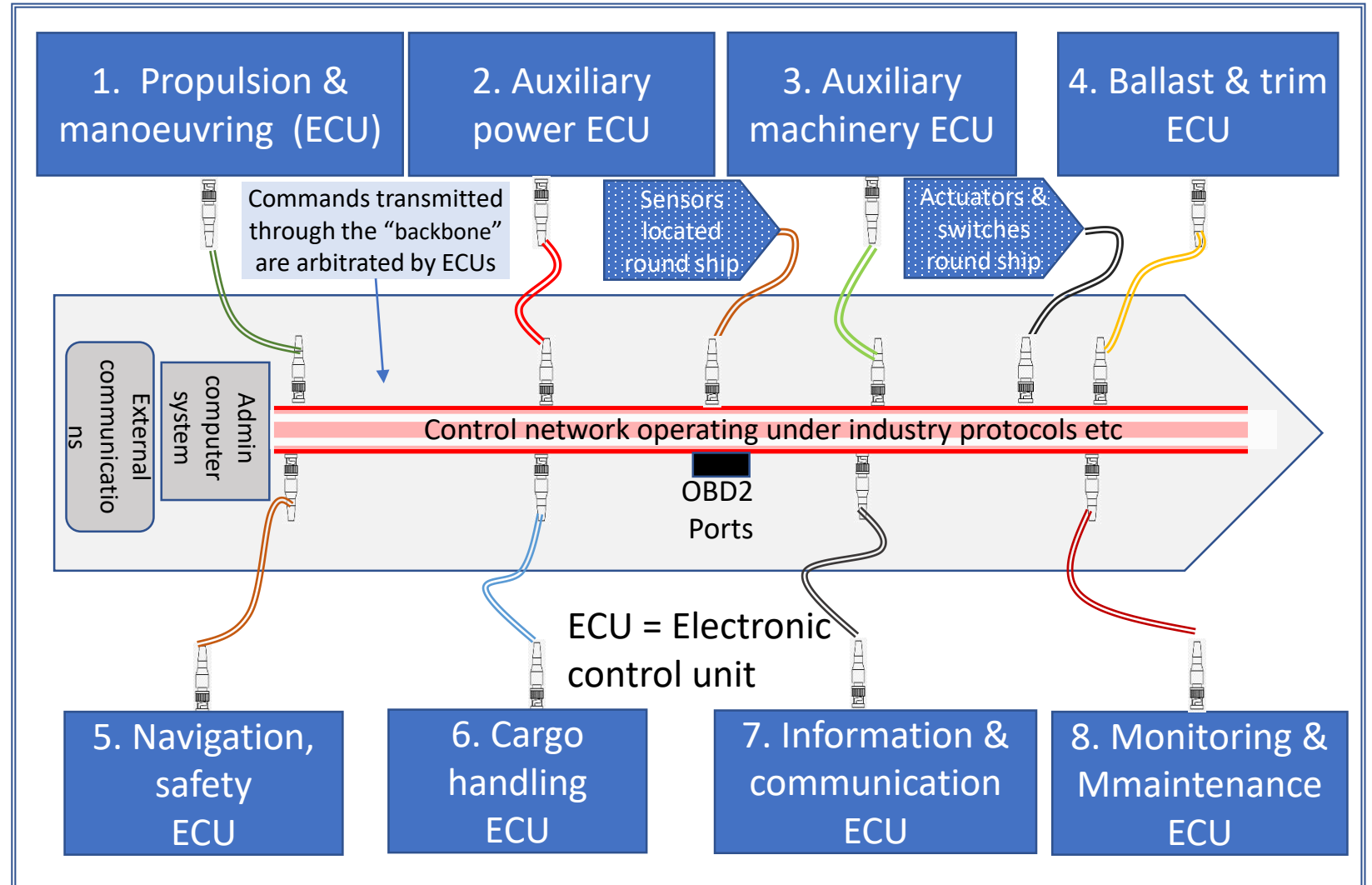


*A "bit" is a binary digit, 0 or 1

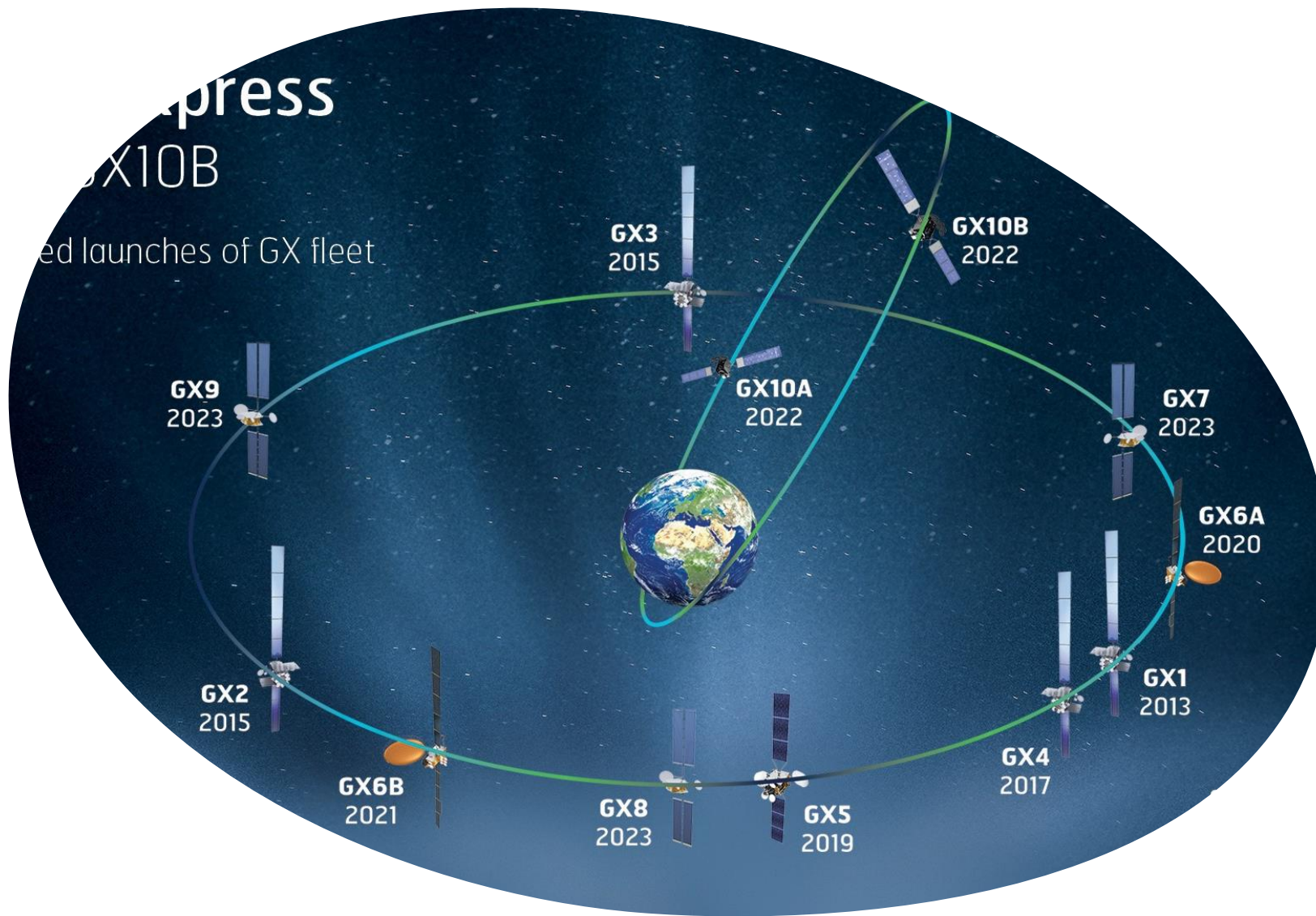
In future messages will replace wiring on ships because:-

1. Replacing point to point wires with networked messages is much more efficient :-

- ✓ **Low cost** – digital network replace expensive point to point wiring.
- ✓ **Efficient** – safety and control algorithms add value & little cost.
- ✓ **QA works better** - error diagnosis routines built in
- ✓ **Robust** – from electrical disturbances
- ✓ **Flexible** – easy to roll out upgrades.




CANbus network for ships – maybe development of NMEA 2000 protocol



3. The key role of satellite communication networks

Inmarsat is rapidly expanding and improving satellite communications

A satellite is shown in the foreground, partially obscuring the view of Earth from space. The satellite has a gold-colored body and several white rectangular panels. The Earth is visible in the background, showing continents and oceans. The sky is dark with some stars.

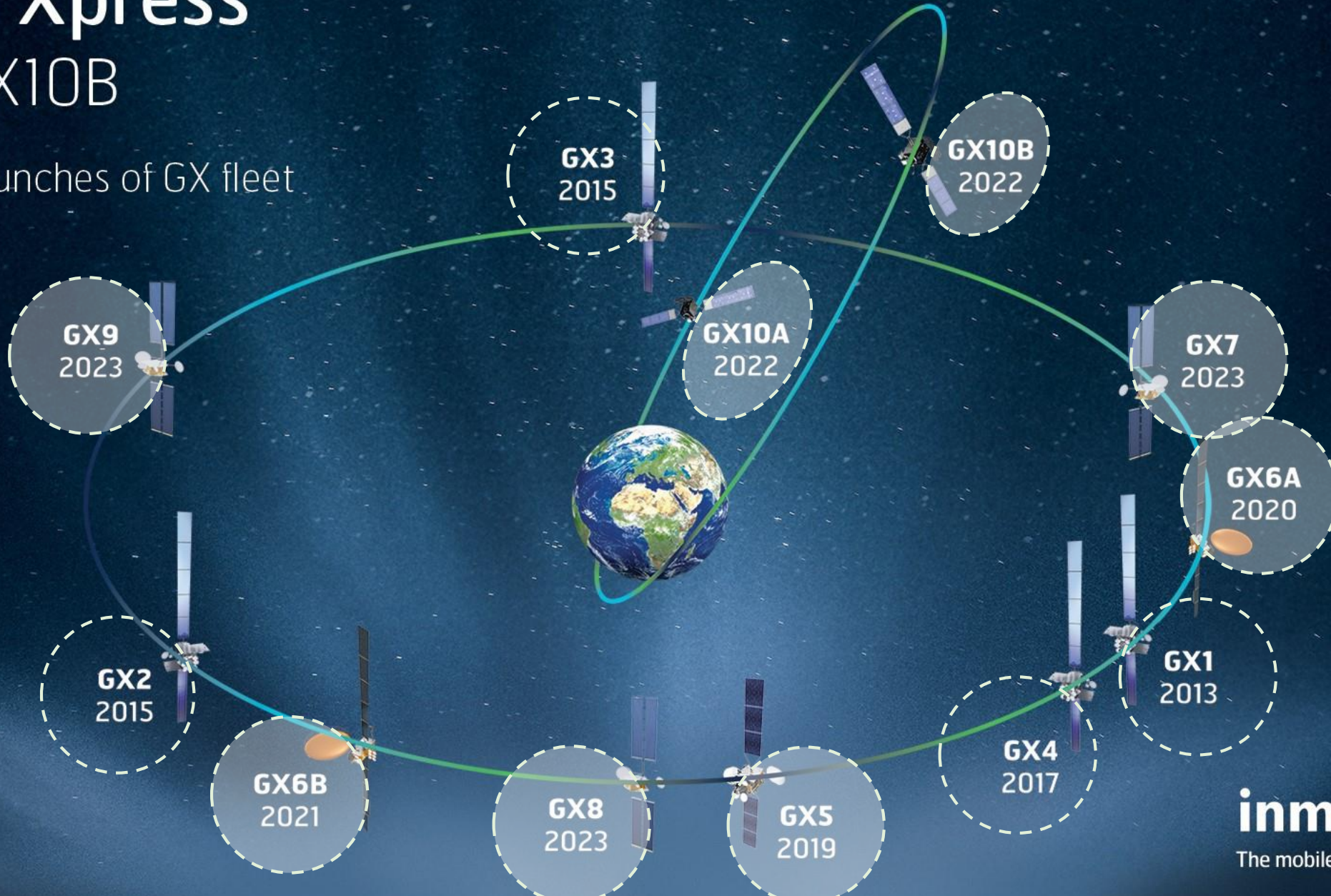
Satellite communications are vital to integrating the operations of ships; shore offices, business partners and customers. Will that capacity really be available? There are 4 points to make: –

- **High growth:** investment program will expand capacity over the next 3 years.
- **Dynamic beamforming** automatically focuses capacity where it's most needed.
- **Fewer dropped lines:** seamless "relocation" between satellites by focusing backup capacity.
- **Version compatibility:** new versions will be backwards compatible (for existing customers)
- **Shorter lead times:** less than 2 years to commission a new satellite.

Global Xpress

GX1 - GX10B

Scheduled launches of GX fleet



Please note that these are indicative positions



4. Conclusions

- Advanced digital networks of micro controllers will revolutionise ship operations – it is already happening.
- Developing networking protocols for big cargo ships would streamline fleet management and emissions reporting
- It's going to be fun – Silicon Valley meets the world's oldest industry!!



That's it
folks, thanks
for listening