GSAW 2011 Implementing Shared Capabilities

Ground Software Integration in Various Bus Architectures:

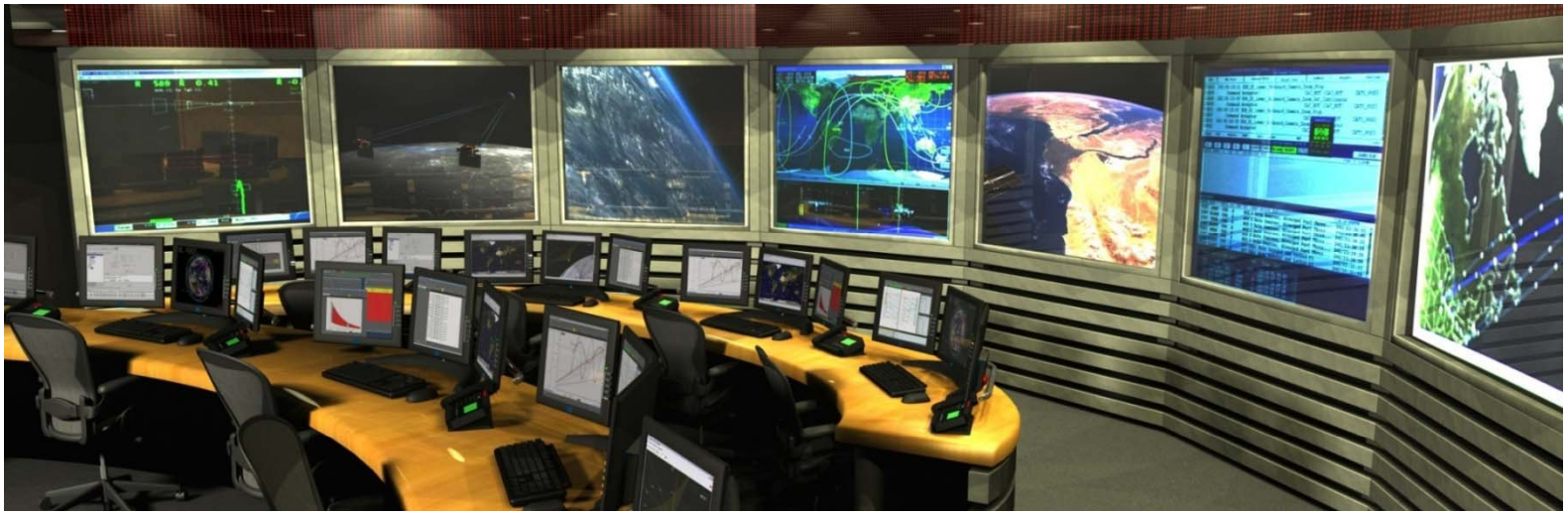
Lessons Learned from Recent Experience

INNOVATING SOLUTIONS

Who Are We?

GMV is….

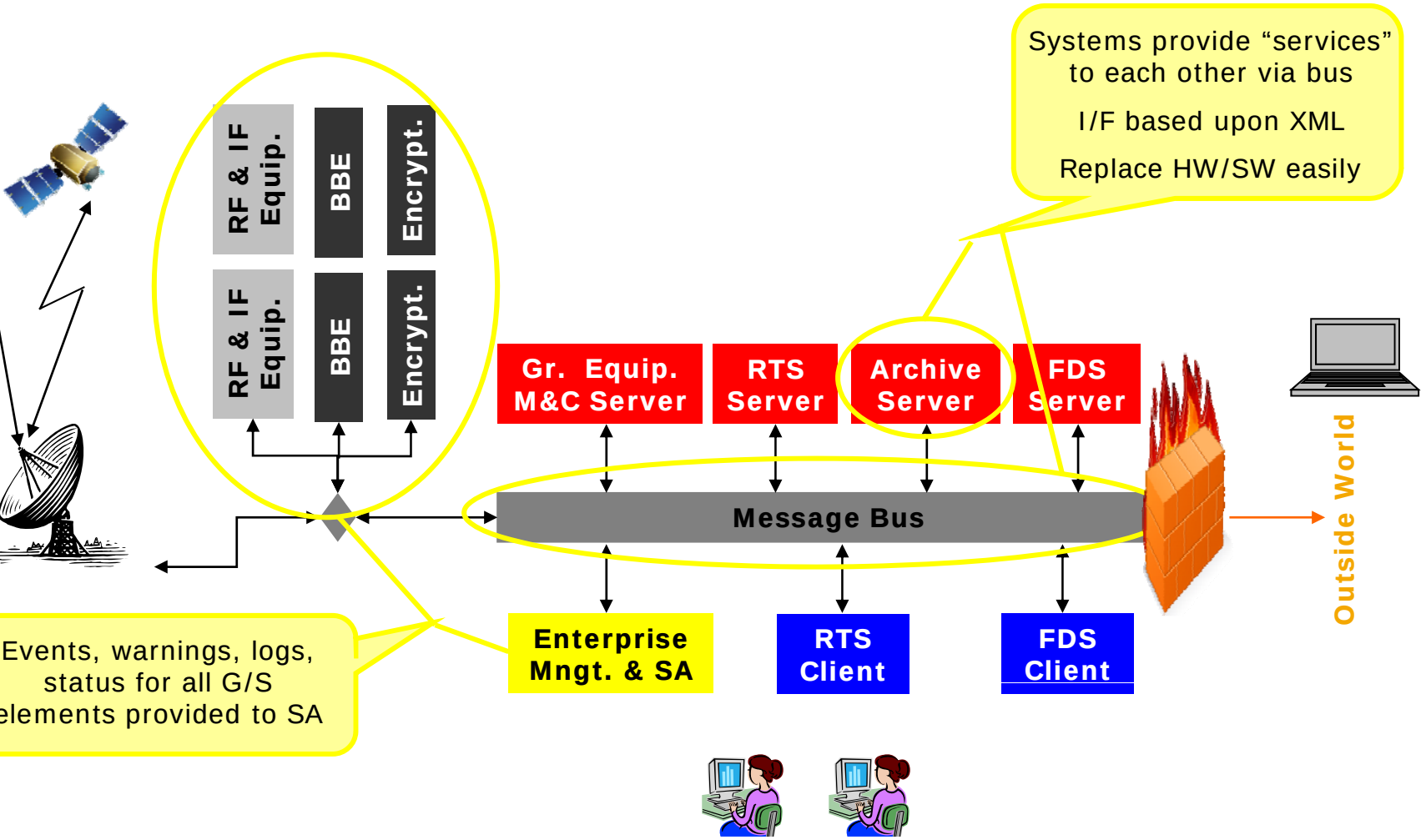
- Privately-owned, family business (woman-owned)
- Established in 1984 with affiliates in the US, Europe and Asia
- ISO 9001 certified, CMMI level 5 certified for SW development
- Space News Top 50: #48 for 2 years in a row
- #1 Commercial telecom ground system supplier in the world
- Only company to sell ground SW to space institutions around the world (NASA, NOAA, USGS, CNES, ESA, Eumetsat, Roscosmos, ISRO, ETRI)
- GMV ground systems deployed to 26 countries on 6 continents



Recent Experience

- 5 GEO fleet migrations successfully completed
- Largest independent GEO fleet migration in the world ever done was successfully completed by GMV in 2008
- NASA Goddard's GMSEC
  - Interoperability standards with wide application
- Satellite manufacturer R&D
  - Test benches to demonstrate spacecraft compatibility
- NASA SGSS and GOES-R programs
  - GMV COTS products fit in to larger architectures
  - SOA is required
  - Dovetails with product development of upcoming GMV COTS versions

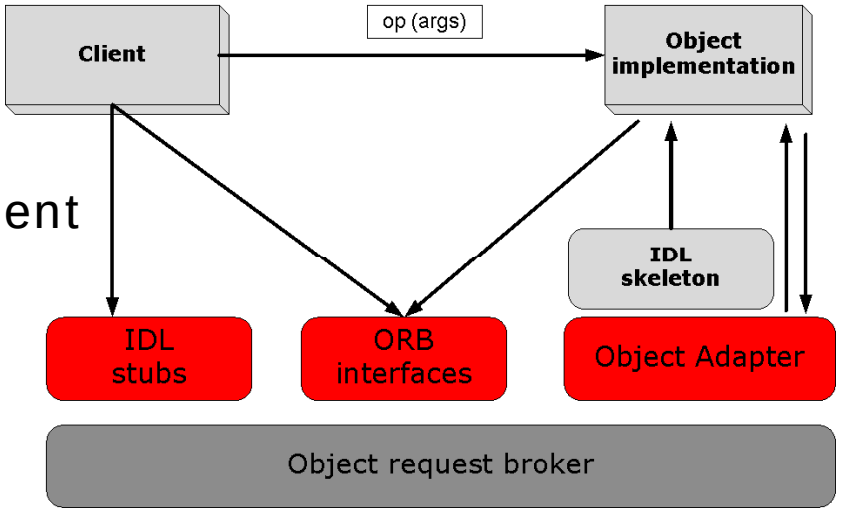
stribution Architectures: Message Bus



stribution Architectures: Corba

Videly used in

- Banking & Finance Online account access
- E-commerce
- Network management
- Hospital Patient Record Management
- Entertainment pay-per-view
- Spacecraft control centers!



imitations

- Significant learning curve
- Complex object life cycle
- Requires bridging to older legacy systems
- Network difficulties (firewalls, non transparent addresses)
- Mobile environment limitations (changing and unreliable network addresses)

stribution Architectures: Web Services

3C Activity to layer
ditional features above
AP and XML

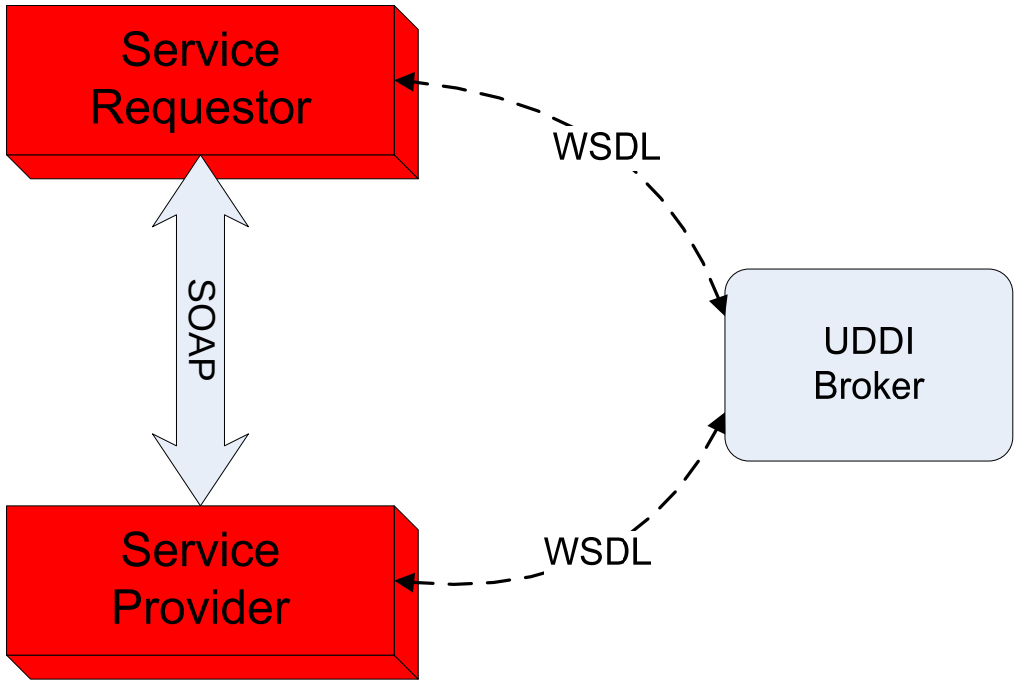
- Service discovery
- Security
- Web Services Description Language (WSDL)

n use other transports

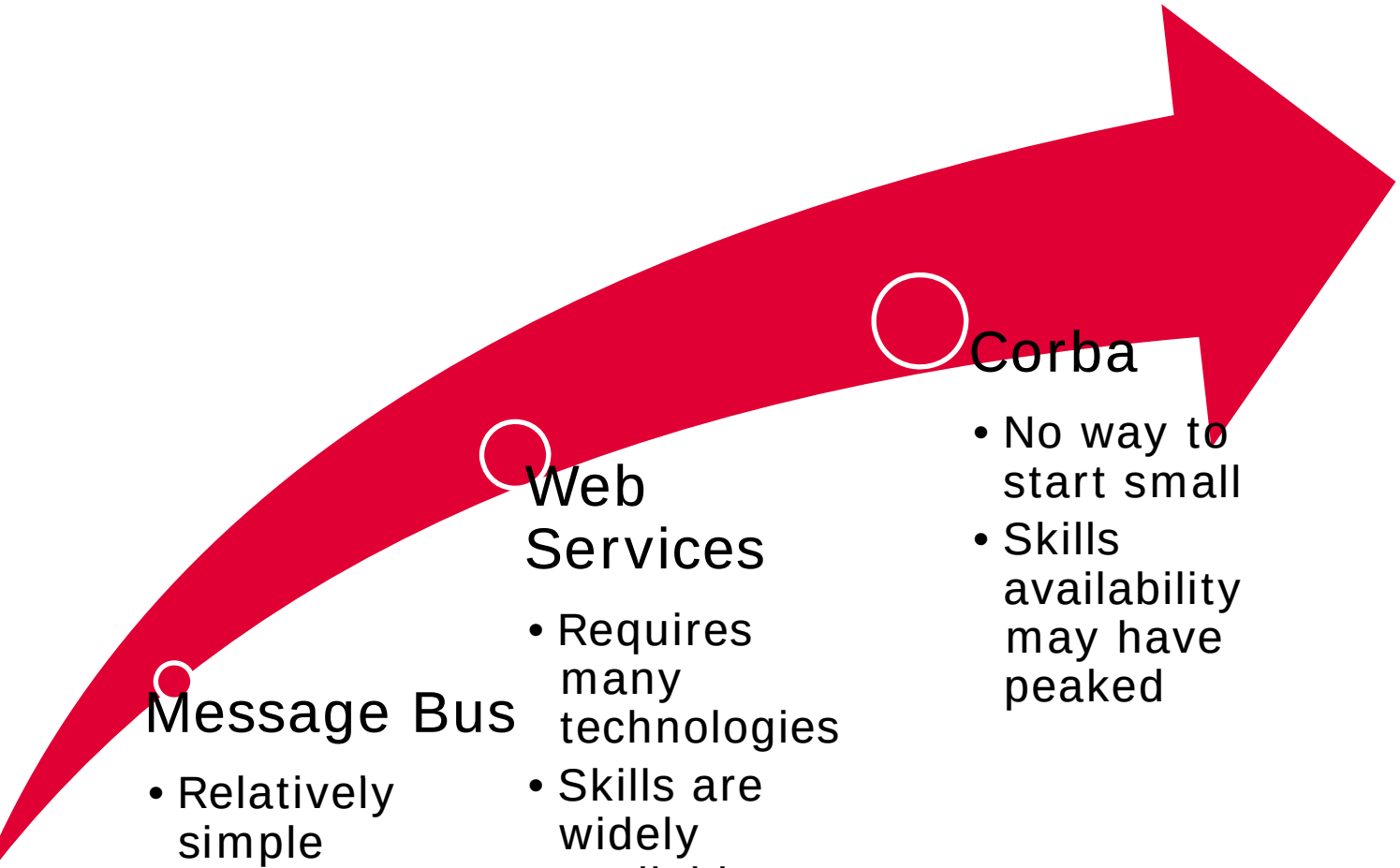
- RPC (like Corba)
- Message Bus

verages the rastructure of the web

- HTTP(S) communications
- URI resource location
- REST techniques aid caching



ade Spaces: Learning Curve



Message Bus

- Relatively simple

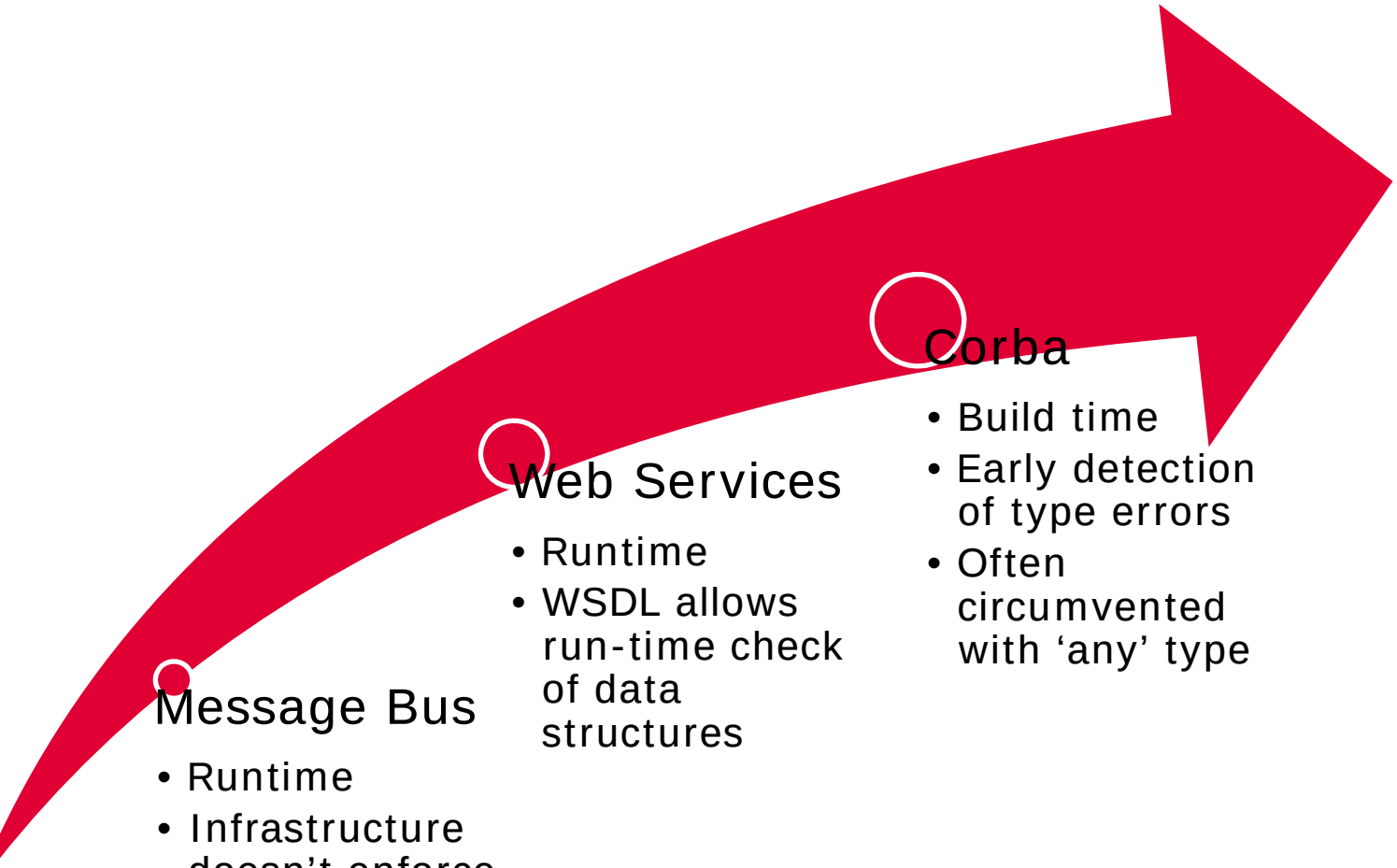
Web Services

- Requires many technologies
- Skills are widely available

Corba

- No way to start small
- Skills availability may have peaked

ade Spaces: Binding



Message Bus

- Runtime
- Infrastructure doesn’t enforce

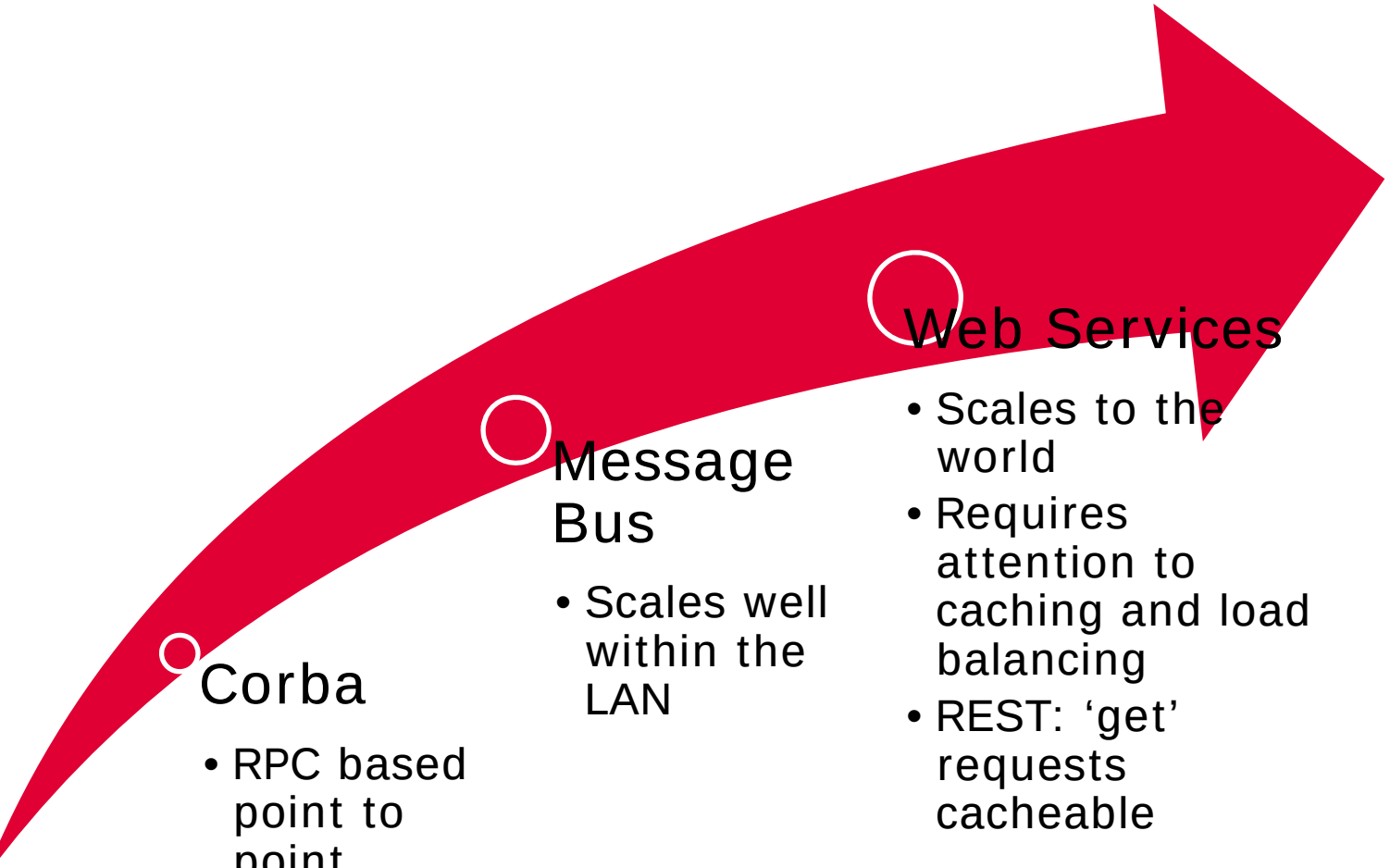
Web Services

- Runtime
- WSDL allows run-time check of data structures

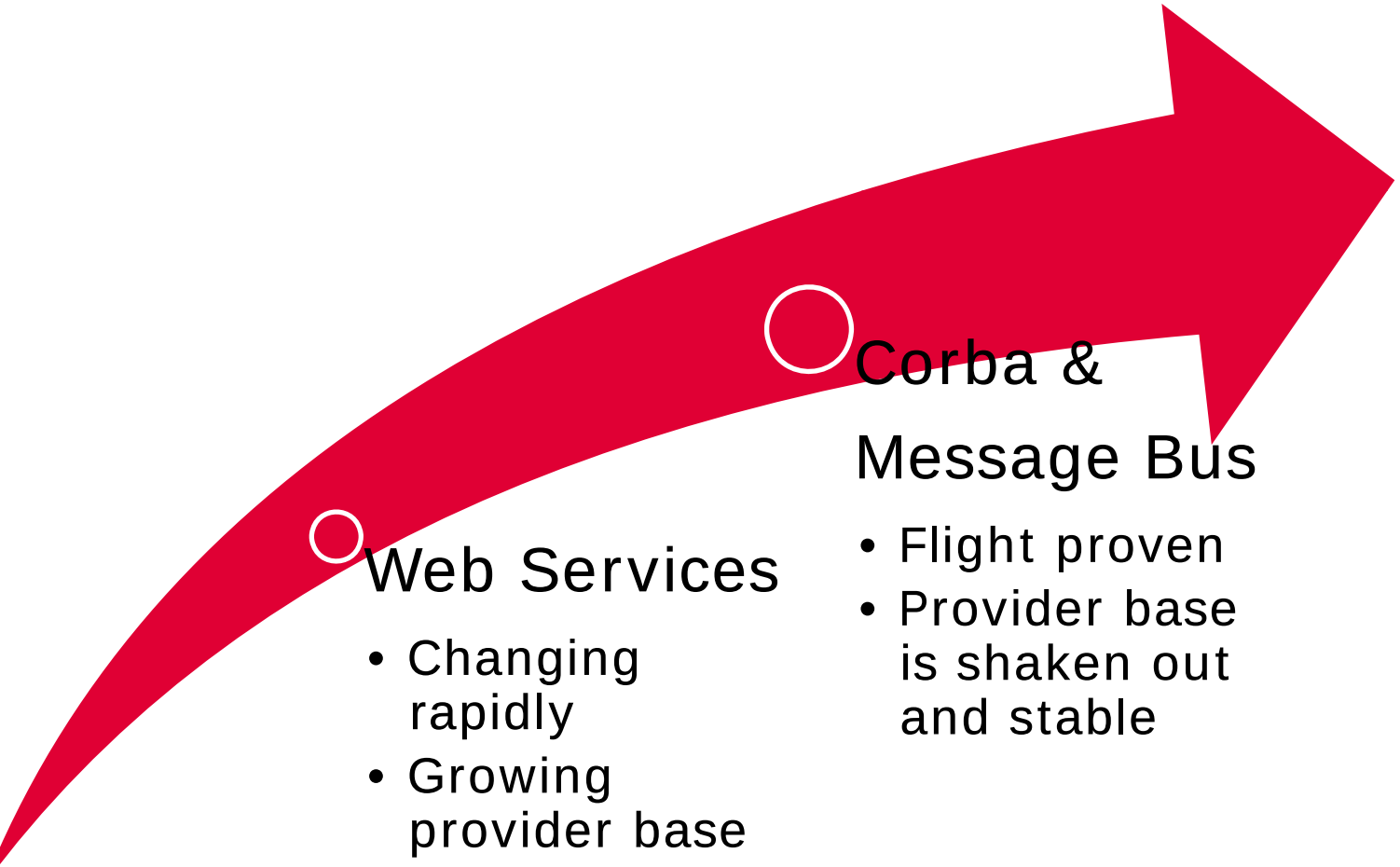
Corba

- Build time
- Early detection of type errors
- Often circumvented with ‘any’ type

ade Spaces: Scalability



ade Spaces: Tool Maturity



Web Services

- Changing rapidly
- Growing provider base

Corba &

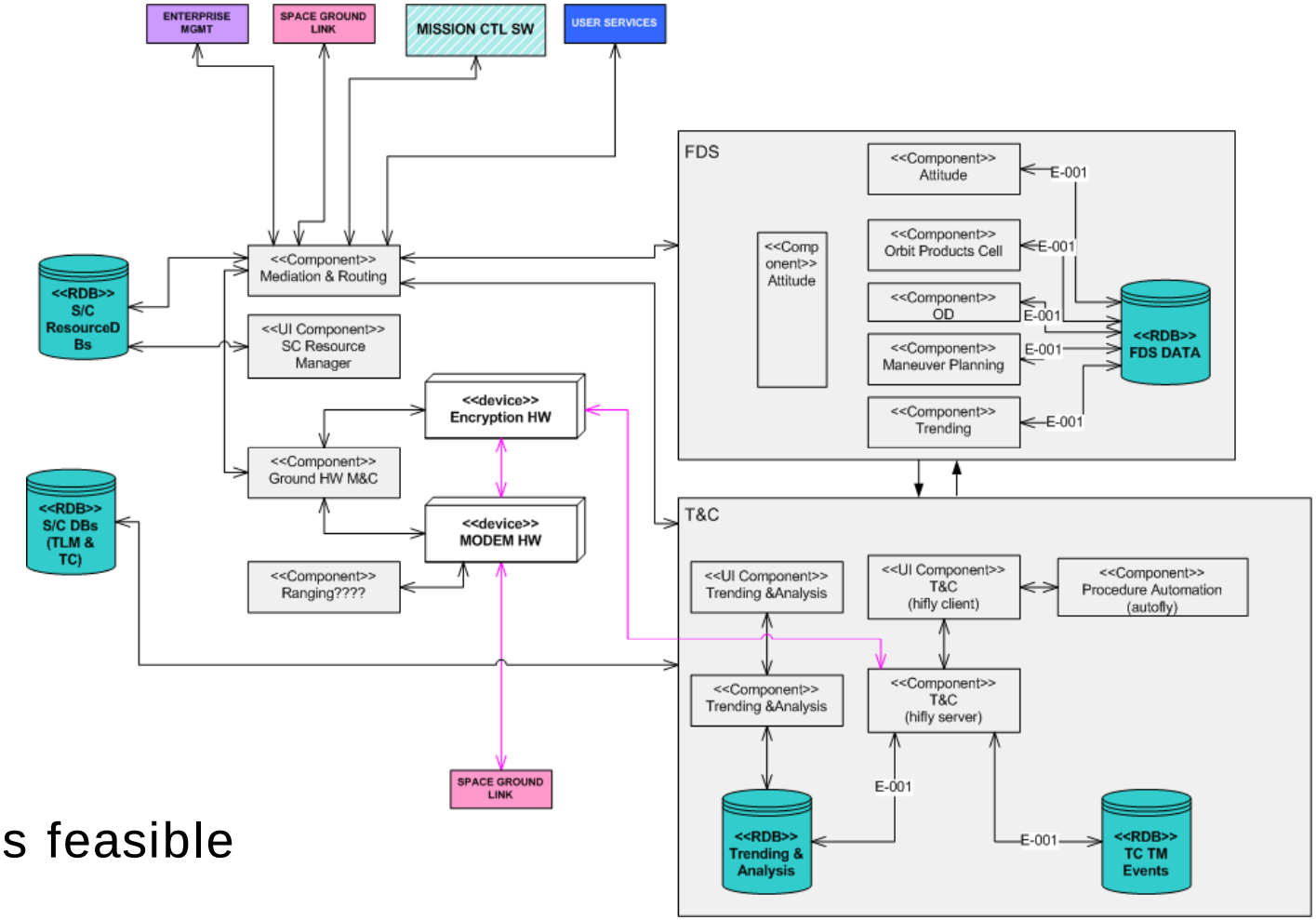
Message Bus

- Flight proven
- Provider base is shaken out and stable

chnical Enablers

e the legacy systems built from distributed components?

e the interfaces fixed and known?



-plumbing is feasible

chnical Disablers

me algorithms are difficult to replicate in new hnologies

- ming sensitive feedback loops
- arefully tuned rule bases
- Black Box' components with lost source code
- e end of the interface is immutable
- he ground system and flight software were eveloped together
- ow the flight side is out of reach (literally!)

We're no smarter than "Those Who Have Gone Before"

tegration Obstacles

ny **barriers** prevent quick deployment of w technologies into existing architectures

Long missions (e.g. typical GEO is 15 years). Difficult cost/benefit ratio for technology upgrade

Operators are **reluctant to lose features** in transition to a new system. *I want everything I have plus a lot more…*

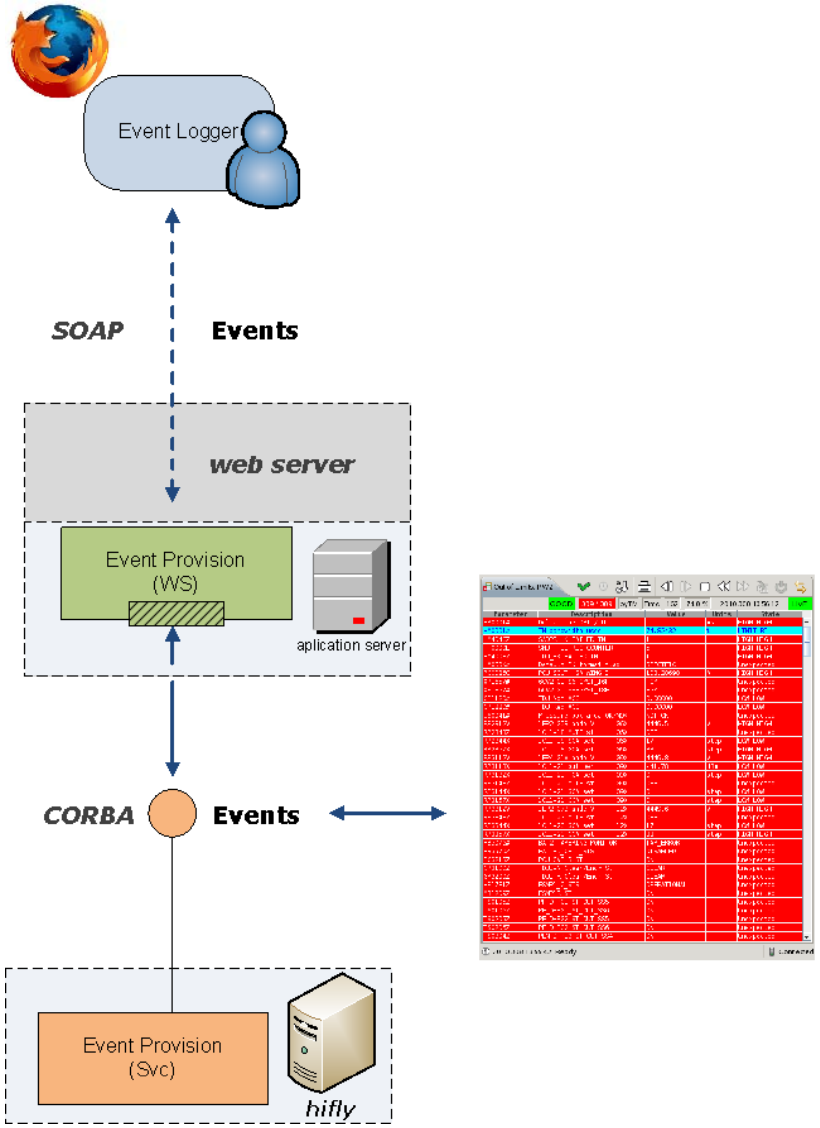
Large **variability** of requirements across missions.

- What works well for one may fail for the next
- Scalability issues (e.g. single satellite vs constellations)
- Difficult to create a ‘generic’ technology that will suit all

Difficult **deployment** of systems and quickly evolving OS

dging

- “green fields”
- Existing operations centers have frameworks in place
- Every component has a legacy tail – otherwise it wouldn’t be selected
- Team skills are long-lead items
- oose bridge points
- Prefer
  - Minimize # bridges
  - Stable component boundaries
- Avoid
  - Latency-sensitive interfaces
  - Introducing critical failures



nclusions

- “one right answer”
  - Message Bus for steady-state flows (e.g. telemetry frames)
  - Web Services for highly variable and scalable client loads
  - Corba for tightly bound internal transactions
- gacy is important
  - Existing equipment and systems may have infrastructure in place
  - Baseline COTS may have a preferred infrastructure
    - Smart vendors are ready to support others as well
  - Maintenance staff may be highly skilled with an infrastructure
- dge as required
  - Systems of systems may require combinations of architectures


Thank you
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