
10th ICCRTS

Towards the Edge and Beyond: The Role of Interoperability

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FGAN – FKIE

GERMANY

- Interoperability
 - ◆ Perspectives
 - ◆ Levels
- Pragmatic Interoperability
 - ◆ What it adds to Semantic Interoperability
 - ◆ What is missing
- Operating in Concert / Self-Synchronization
 - ◆ Hindrances
 - ◆ Orders and Responsibility
 - ◆ The Role of Hierarchy in Edge Forces

*“In order for a force to possess the capabilities described above [edge capabilities], the force needs [...] two key force-level attributes: **interoperability** and **agility**.”*

Alberts & Hayes (2003):

Power to the Edge (p.105)

*"The ability of **systems**, **units**, or **forces** to provide services to and accept services from other systems, units, or forces, and to use the services so exchanged to enable them to **operate** effectively **together**."*

NATO Definition

Two perspectives can be distinguished:

- Interoperability among **IT-systems**
- Interoperability among **forces**
(**users of the systems**)

The perspectives are connected insofar as **users** have to **compensate** interoperability gaps of their **systems**.

⇒

Improved Interoperability among **systems** frees up the **users** who then can concentrate on essential tasks.

“Improved interoperability”
refers to “Levels of Interoperability”
as formulated and discussed
by *Levels of Information Systems Interoperability (LISI)*,
by the *NATO Interoperability Directive (NID)*,
and also by *Albert & Hayes: Power to the Edge*.

- D0: Missing Interoperability
- D1: Physical Interoperability
- D2: **Syntactic** Interoperability
- D3: **Semantic** Interoperability
- D4: **Pragmatic** Interoperability

← **Language**

- **identical interpretations** of the information exchanged
 - ⇒ shared knowledge
 - ⇒ common operational picture

What is missing?

- The addressee still has to realize the **communicative intention** of the sender.
- The ability to operate in concert (self-synchronization's precondition)

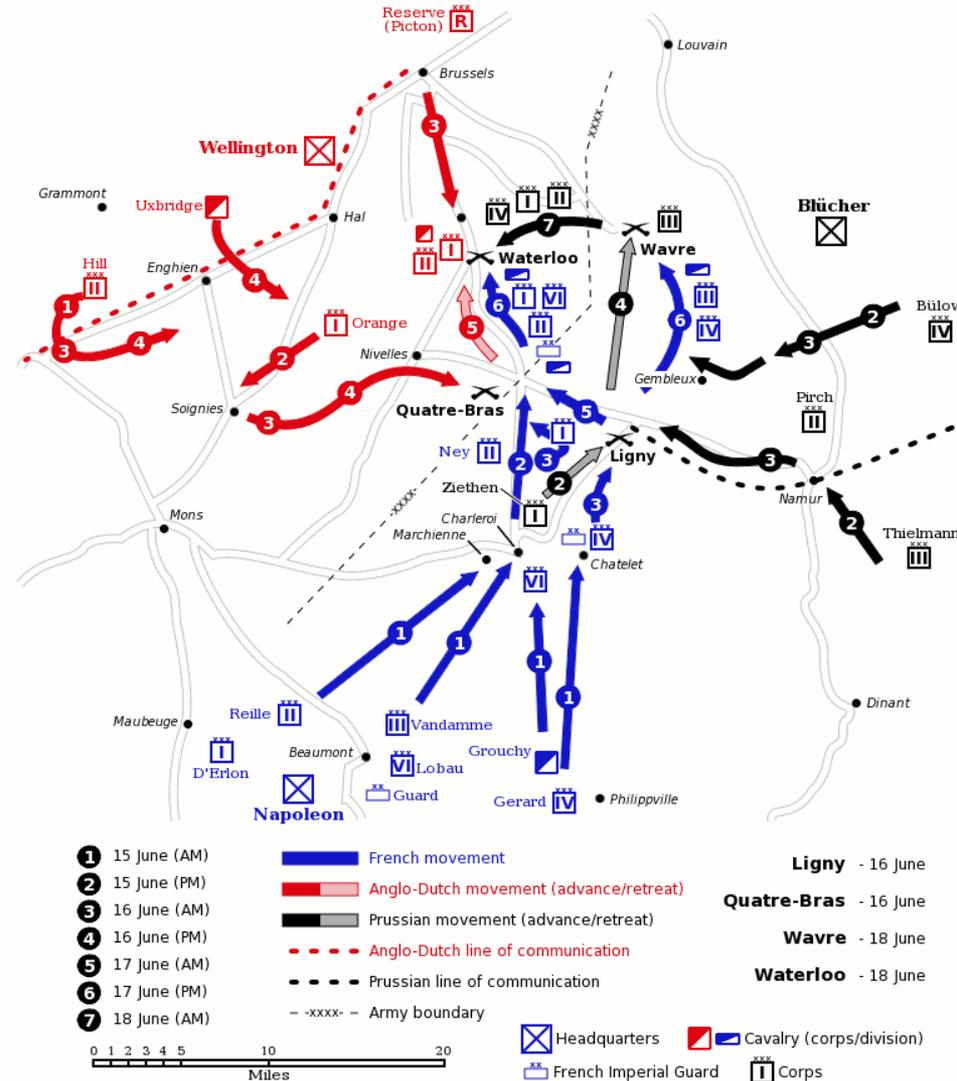
without
pragmatic interoperability

Example: Waterloo 1815

Marshall Grouchy followed
Napoleon's order **literally**
to pursuit the Prussians.

He did not follow Gérard's
appropriate advice:

»il faut marcher au canon«.



NID: Degree 4

Enterprise Interoperability in a Universal Environment

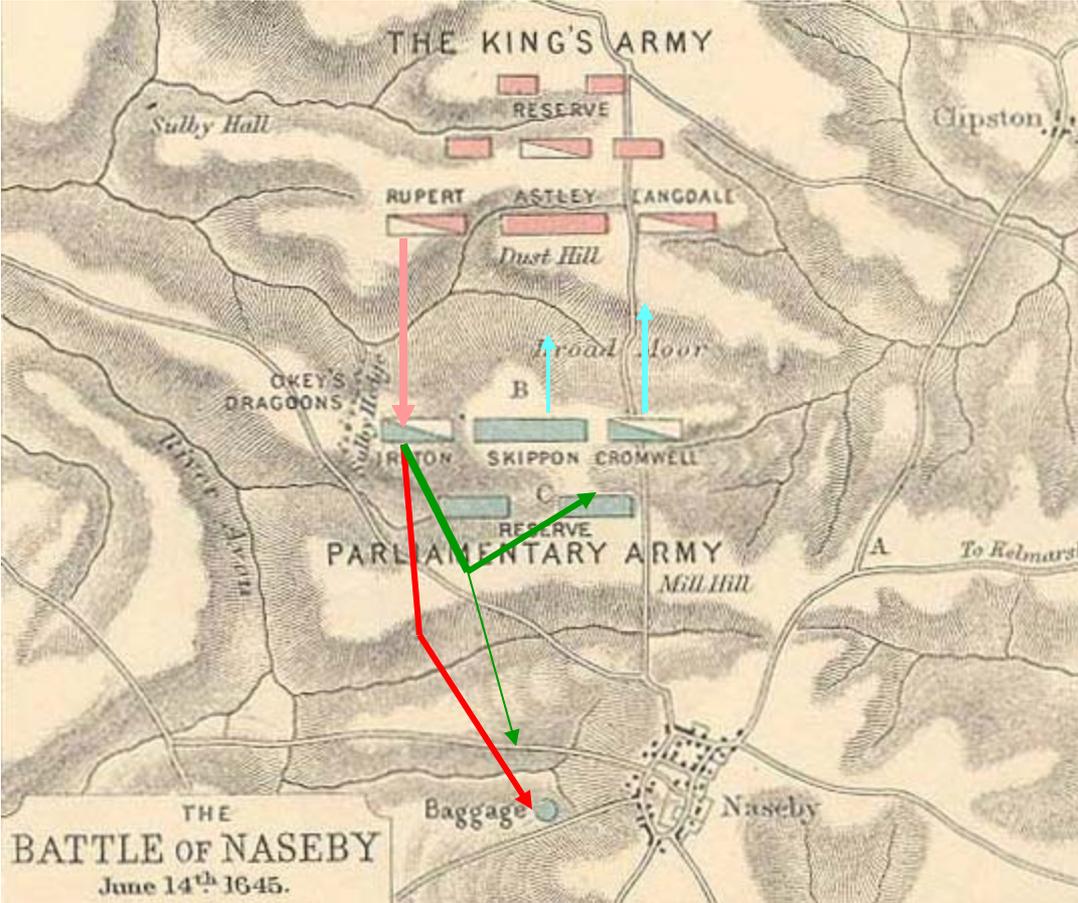
*The key feature of Degree 4 is a top-level perspective that includes enterprise data models and procedures, where data is seamlessly shared among the applications that **work together** across domains in a universal access environment.*

- shared **knowledge**
- shared **communicative intentions**

What is missing?

- The coercion to operate in concert
(self-synchronization's ignition)

Operating in Concert: Example



wrong

Naseby
1645



right

Kynoskephalai
197 BC

The preconditions for operating in concert are that everyone has a

- clear and consistent understanding of command intent
(cf. Alberts & Hayes)
- and acts accordingly.

In hierarchical organizations, the latter is enforced by orders (for what hierarchy provides the necessary authorization).

Orders overrule what may hinder operating in concert.

These hindrances are

- *hubris* (example: Arausio 105 BC)
- *extensive caution* (example: Antietam 1862)
- *self-preservation* (example: Antietam 1862)

Edge forces operate in concert by self-synchronization.
Self-synchronization is based on

- Clear and consistent understanding of command intent;
- High quality information and shared situational awareness;
- **Competence** at all levels of the force; and
- Trust in the information, subordinates, superiors, peers, and equipment.

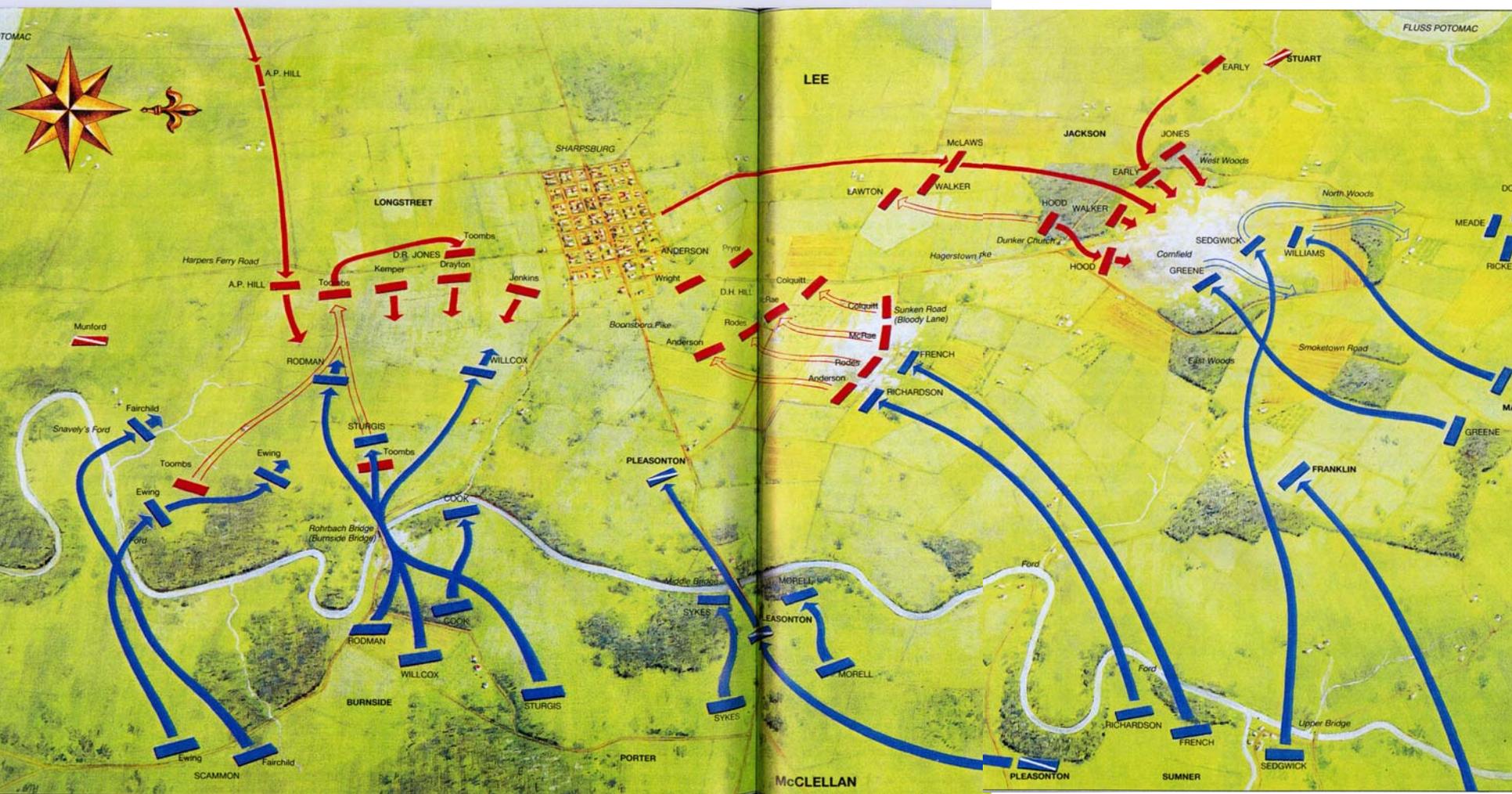
Alberts & Hayes (2003):
Power to the Edge (p.27)

- ~~Hubris~~ as well as
 - ~~Extensive Caution (Inaction)~~
- are prevented by **competence**.

But

- *Self-Preservation*
- remains a problem.

Antietam 1862



[from Davis (1989): Battlefields of the Civil War]

Antietam 1862



Alex Gardner, photographer
Sept. 1862

Antietam 1862



[painted by John Paul Stra...

- *hubris*?
 - *extensive caution (inaction)*?
- are prevented by **competence**

Even more, competence is a **fleeting property** which cannot be granted in advance.

- It must be possible to counter incompetence.
- It must be possible to overrule self-preservation.

Command is the tool.

But, command has – in advance –
to be grounded on **authority** and **responsibility**.

Command is the tool.

It has – in advance –
to be anchored in a (flat !) hierarchy.