



U.S. Army Research, Development and
Engineering Command



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



Edge Enabled Systems

19 May 2010



The Problem



Traditional military systems are developed and fielded by programs of record

- Adhere to strict acquisition policy (DoD 5000)
- Discourage modifications by users in the field

For good reasons: performance, security, availability, etc.

But...

Today's Warfighters are engaged in asymmetric warfare, against a highly networked and agile enemy

- Rely more than ever on information technology
- Must adapt to changes in their environment and enemy tactics

These are conflicting!

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



US ARMY
RDECOM

The Solution



★ **CERDEC**
US ARMY - RDECOM

Warfighters have substantial and ever-increasing levels of technical skills

- Some are capable of modifying systems in response to needs that were not anticipated by their designers

Software the Warfighter uses
must be *adaptable*



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.



The Solution Cont'd



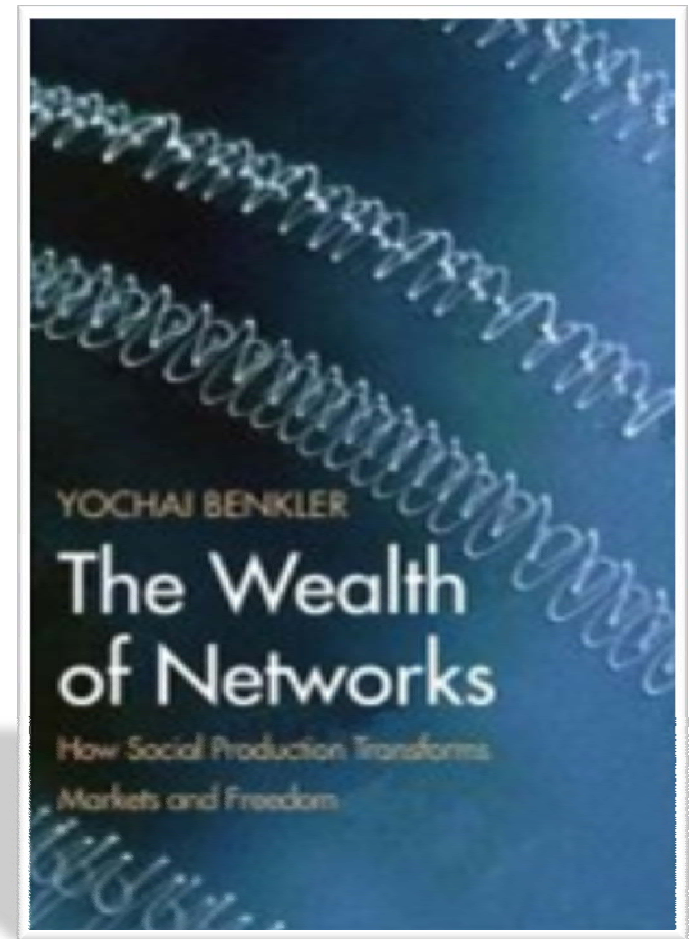
We need to facilitate creativity and innovation “at the edge”
without compromising core system qualities

We call this **Edge Enabled Systems (EESs)**



Yochai Benkler's *The Wealth of Networks*:

- we are in the midst of a “radical transformation” of how we create our information environment
- this transformation is restructuring society; models of production and consumption
- Benkler calls this *commons-based peer production*





Service-Dominant Logic



- Service industries account for 55% of economic activity in the United States
- Businesses have moved from a *goods-dominant* view, to a *service-dominant* view
- In this new view customers are seen as *co-creators of value*



A Sea Change



- These changes are much more than just a shift from goods to services
- They are a reframing of the purpose of the enterprise and its role in value creation
- They are creating new phenomena, e.g. super-linear growth in projects, emergent behaviors in systems...

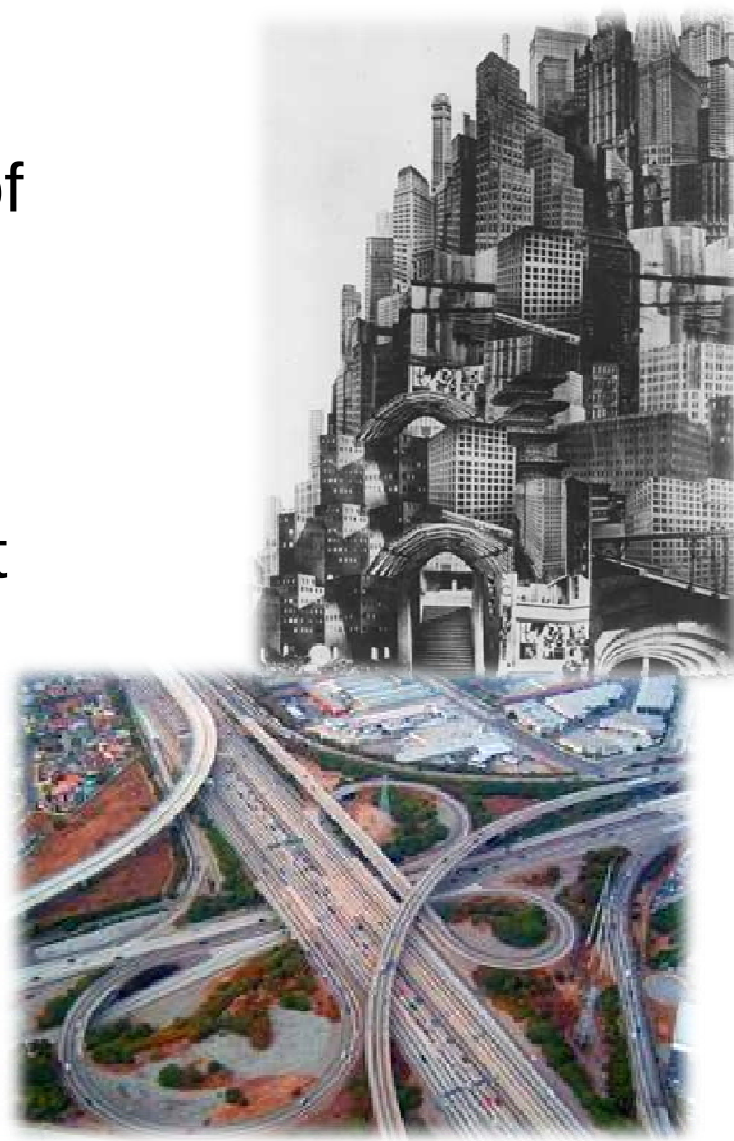


Implications for the DoD



- All change introduces risk, and all change is disruptive
- Edge enablement is especially disruptive to an organization such as the Army where the consequences of risk may be life and death
- Inhibitors:
 - *Established Practices*
 - *Cultural Disconnect*
 - *Information Assurance and Policy*
 - *Security and Classifications*

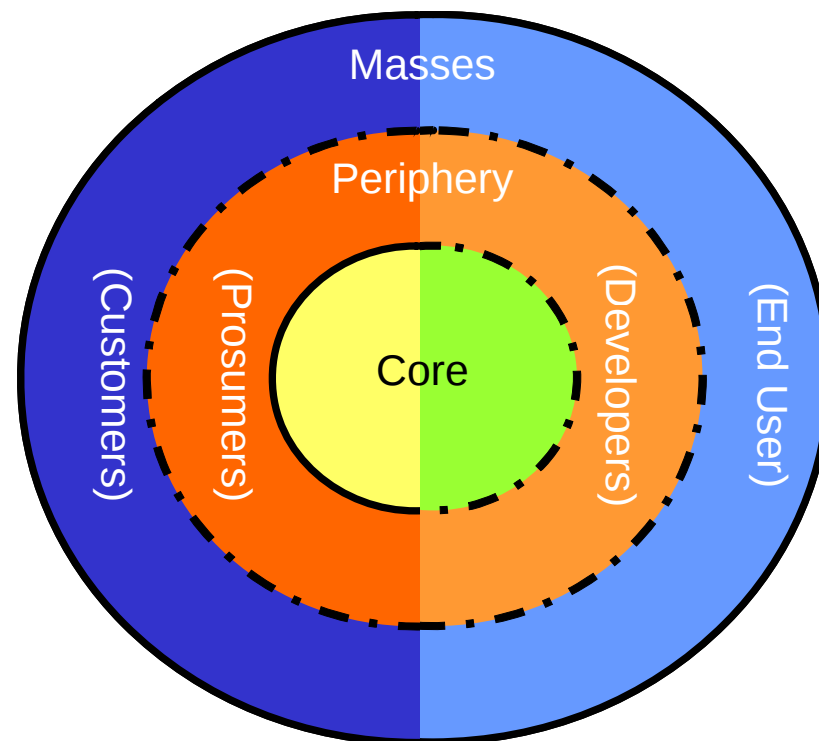
- We suggest that a new model of software creation is needed, based on the *Metropolis Model*
- This model helps us think about system creation that is *commons-based* and *peer produced*:
 - MySpace, YouTube, Twitter, Facebook, Hi5, Wikipedia, Orkut, Craigslist, ...



All successful EESs and organizations share a common structure:

A Metropolis structure:

- the core ensures critical system qualities
- users (developers, prosumers) are enabled at the edge





Metropolis Model Characteristics



1. *Mashability*
2. *Conflicting, Unknowable Requirements*
3. *Continuous Evolution*
4. *Focus on Operations*
5. *Open Teams*
6. *Sufficient Correctness*
7. *Unstable Resources*
8. *Emergent Behaviors*



Managing the Edge



- What mechanisms can be employed for facilitating the edge?
- What are their advantages and disadvantages?



Mechanisms for Managing the Edge



- Configuration
- Scripting
- Application Platforms
- Sandbox
- Qualification
- Monitoring
- Adaptive Need-to-know Information Access



A New Model of Software Development and Acquisition



- The “Edge” is the intersection between users and their operating environments
- If future systems are to be EESs then the organizations that are tasked to build these systems must change.



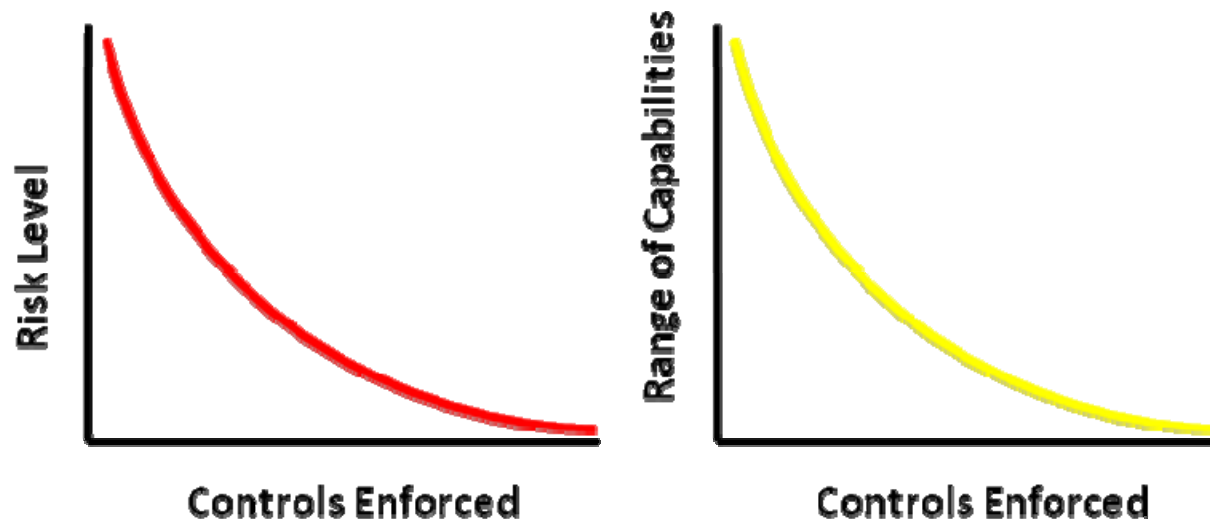
Recommendations



- *Leadership and Management*
- *Project Structure and Communications*
- *Requirements Management*
- *Quality Assurance*
- *Architecture*
- *Delivery Mechanisms*



- An EES creates operational risks, as compared with the “locked down” systems of today
- A locked-down system also creates risks—from being poorly aligned with the needs of the Warfighter





Resulting Questions



★ **CERDEC**
US ARMY - RDECOM

- How adaptable should the system be?
- What development principles should be employed to maintain to ensure EESs?
- What project management procedures and methods should be applied to EESs?
- What fundamental changes must occur in the QA process during fielding and operating of an EES?
- What fundamental changes must occur in the acquisition organization and their processes?
- Does an organization provide additional incentives to the participants?



Recommendations



★**CERDEC**
US ARMY - RDECOM

- To make progress in enabling the edge we believe a documented, repeatable method is required, including:
 - a classification of edge problems and selection of problems for experimentation
 - empirical analysis of EES mechanisms
 - development of an Edge design and evaluation methodology