

# AAAI Spring Symposium Series

*Palo Alto, California*

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AI WELCOMES SYSTEMS ENGINEERING: TOWARDS THE SCIENCE OF  
INTERDEPENDENCE FOR AUTONOMOUS HUMAN-MACHINE TEAMS

# Systems Engineering-Based Design & Development of AI/ML Capabilities

(Part I - Motivation) – This Talk  
(Part II – Deep Dive) – Jim Llinas' Talk

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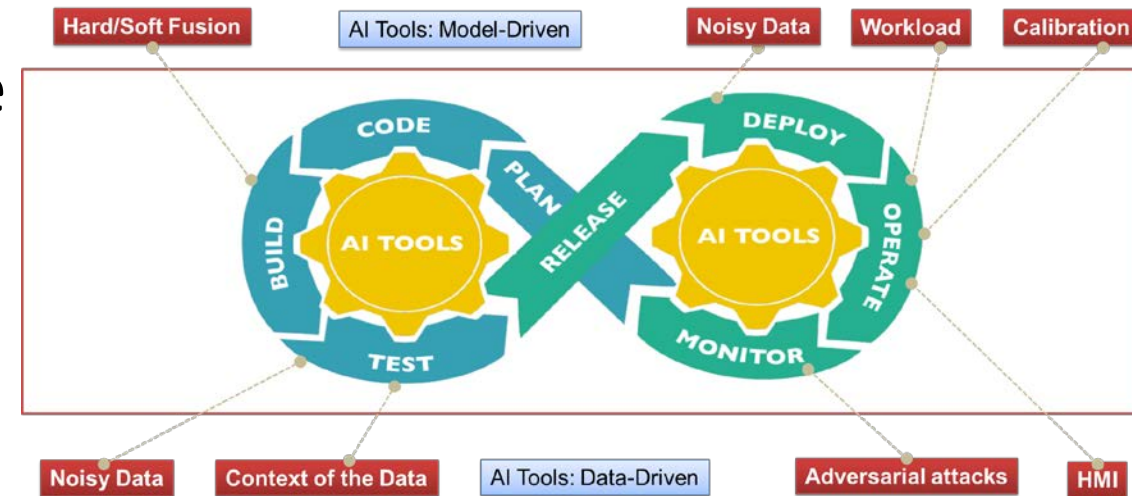
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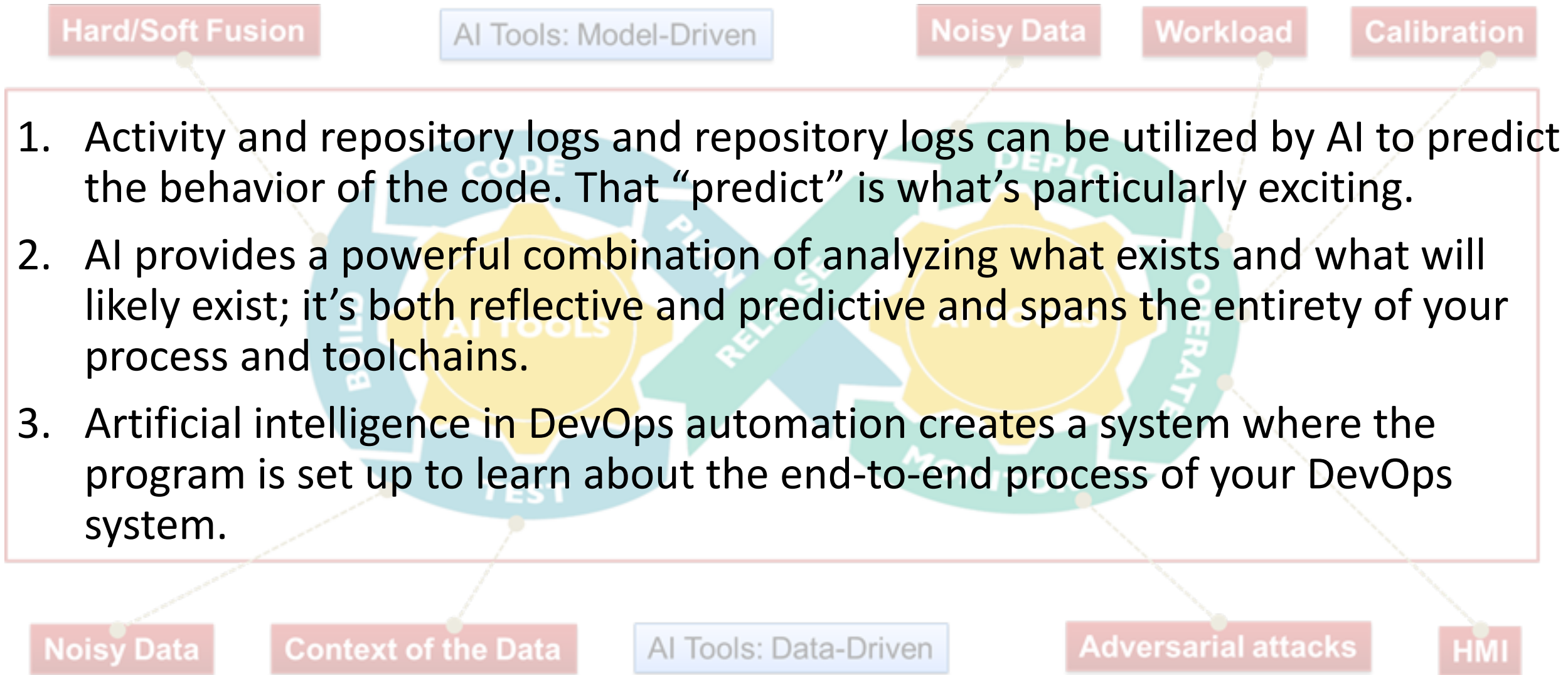
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## Why consider the interdependence of AI and SE?

- Current state of deep learning – where it works well, where it doesn't
  - Works well when you have lots of good training data
- Where good data isn't available, leverage broader field of AI
  - Techniques that don't rely as much on data
- Feature engineering, hence data fusion, becomes important
- The scale and complexity of a DevOps will begin increase due to such interdependencies and other factors (**noisy data, adversarial attacks, etc.**)
  - Systems Engineering principles become important!



# AI-enabled automated testing in DevOps, or "Why we will never manually test anything again"



# Automated Tactical Service Oriented Architecture (TSOA) Testing: Sentry Agent Framework (SAGE)

## Naval Need Addressed

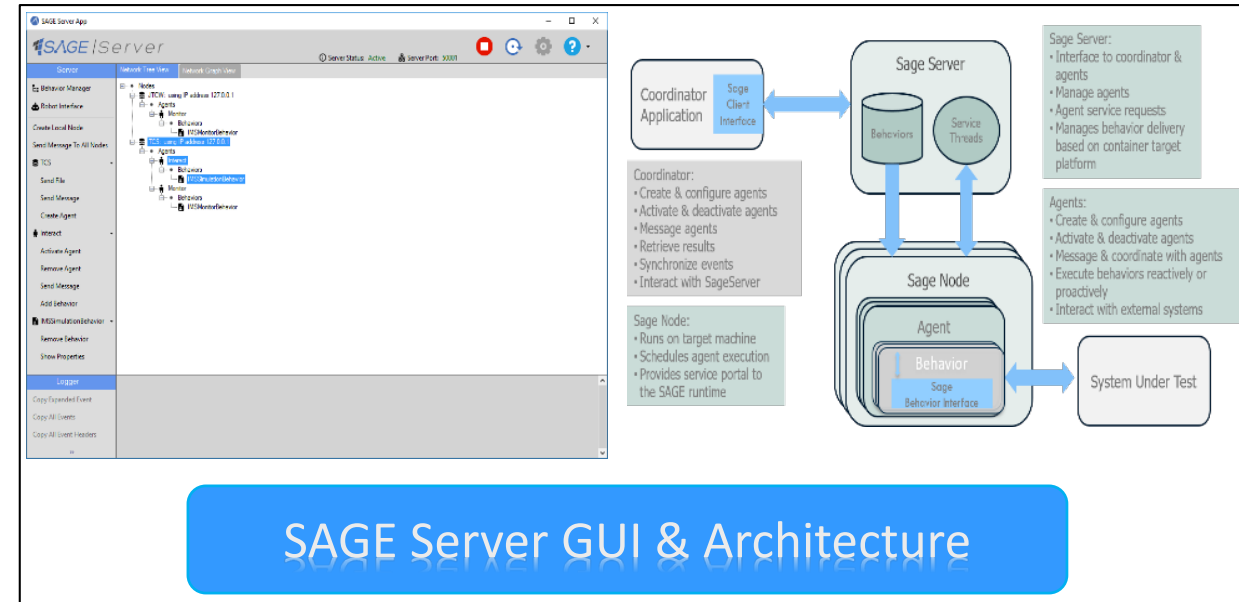
- The Tactical Service Oriented Architecture (TSOA) is modular suite of government owned software components that enables the sharing of tactical data across disparate authoritative data sources (ADSS) within the USMC's Combat Operations Centers (COCs).
- General S. W. Busby has mandated TSOA compliance for all new and legacy MAGTF software by the end of FY18.
- Ensuring the stability and durability of the TSOA infrastructure operating on the tactical edge is paramount to mission success.

## Description of Capability

- Automated evaluation of SOA systems is a difficult problem due to the complexity inherent in modeling the dynamic interactions that occur within a system of systems (SOA).
- The Sentry AGEnt (SAGE) system is a novel, multi-agent test automation framework that integrates disparate test automation technologies into a coherent agent network that can effectively interact with, and monitor the operation of the full TSOA system under test.

## Value to Warfighter

- Using SAGE automation, SPAWAR Atlantic has seen a time reduction in test planning, setup, and execution of 90%.
- Test automation using SAGE enables a significant increase in test coverage as well as the ability to conduct performance testing in simulated challenged operating environments.
- A stable TSOA infrastructure ensures reliable information sharing of mission-critical information across the battlefield.



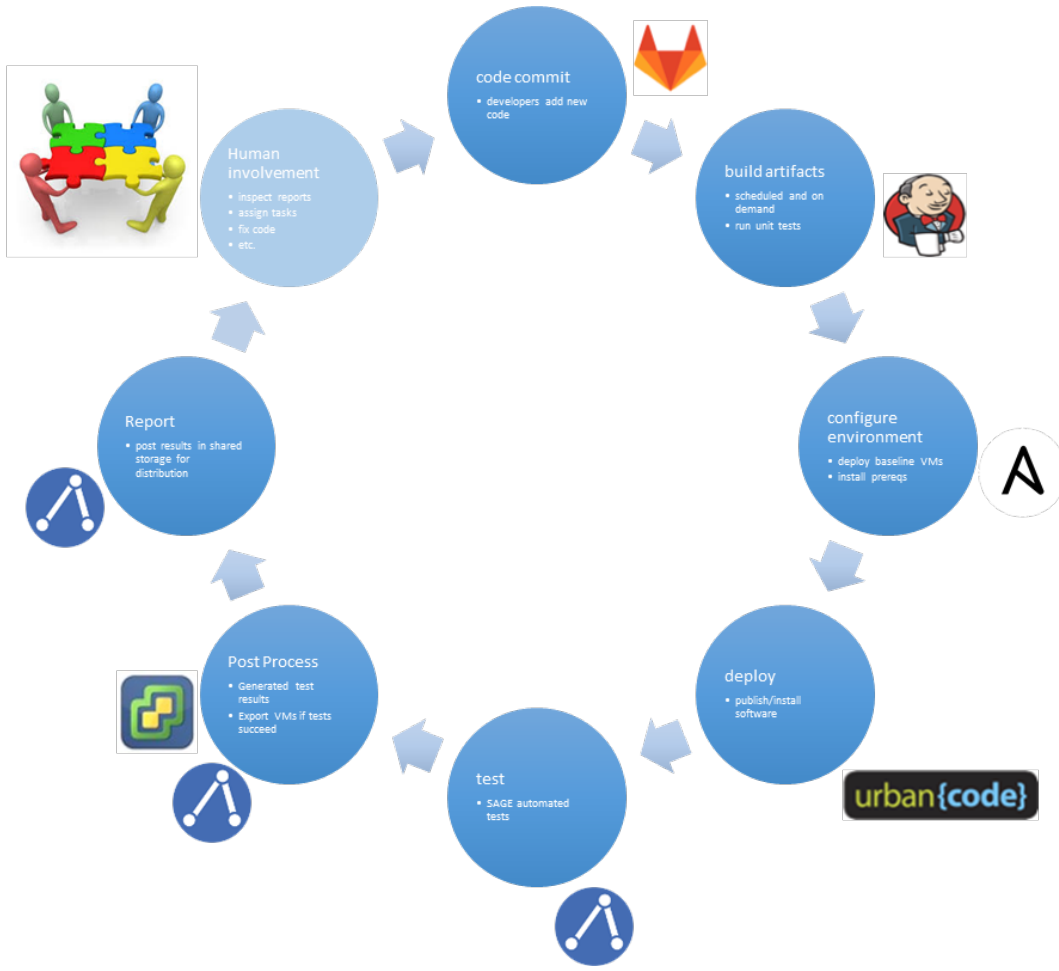
## Users/Receiving Program

- Marine Corps Systems Command (MCSC)
  - Combat Operations Centers
- SPAWAR Atlantic
- SPAWAR Pacific
- Automated Test and Analysis (ATA) N94
- Mitre Corporation

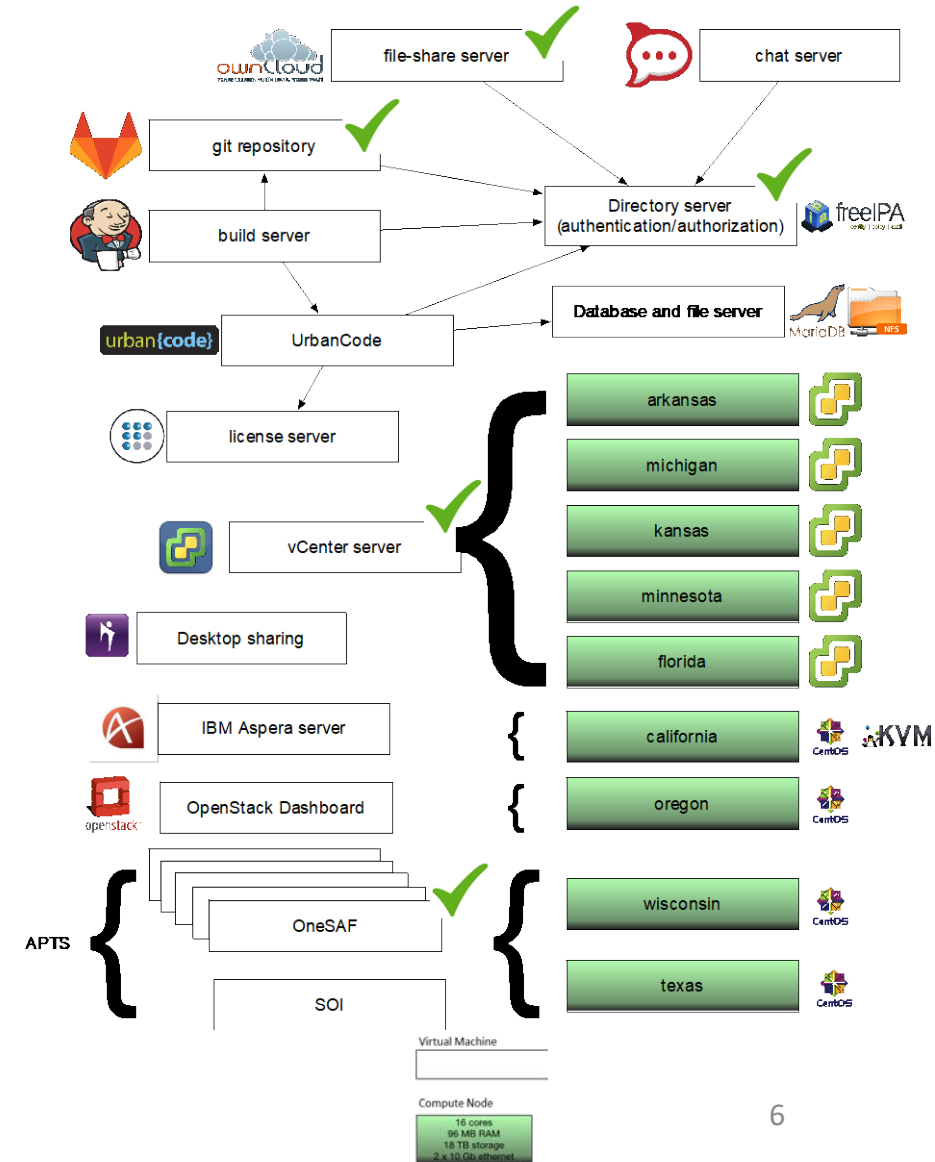
## S&T Origin

- Derivation from prior NRL 6.2 Base project on multi-agent systems. The Base project was a collaboration between 5584 and 5522 to investigate multi-agent coordination in mobile and dynamic ad-hoc network environments

# NRL Compute Cloud Services



- Hosting
  - VMware vCenter
  - OpenStack
- Code Repository
  - GitLab
- Build and Deployment
  - Jenkins
  - GitLab CI
  - IBM UrbanCode
- File Sharing / repository
  - OwnCloud
- Chat
  - RocketChat
- Desktop Sharing
  - Smart Bridgit







# A2I Summit: Technical Insights

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- Common Development Operations Environment
  - Must be Accessible to the entire development community
  - If data cannot be made available due to security concerns, then “Representative” data sets will need to be developed to allow algorithm development & testing
- Architecture:
  - Standards need to be defined: including those for reusable services & Micro-services
  - Software. Having a library of proven & accepted development software would significantly facilitate development across the enterprise
  - Hardware. What is expected to be available where in the enterprise?
  - Factors that affect these: Cyber; Scale (not wanting vendor lock in capabilities), ability to integrate capabilities from numerous sources.
- Infrastructure: What will the Navy maintain & make available?



# Speeding Innovation & Transition

- Industry and academia is hungry to understand where government is going, what government is thinking...
  - Consider an Annual AI Partnership “Conference,”
  - Develop rapid reaction funding mechanism within ONR for S&T
  - PEOs need a consistent “Innovation Business Model” e.g. IWS5 APB process.
- Scale: Came up as a recommendation on various topics: hardware, algorithms, software...
  - Successful A2I should develop small – but with a strategy for scale
  - Need dedicated workshop on scalability issues for the application of AI
- For user trust and transition:
  - AI decision steps need to be small enough to see AI decision choices for comprehension, trust, support centers fixing issues ( - and this is probably relevant to not having vendor lock) (scale)
- Users: Not just end users. The entire task flow for AI development needs to be examined for all the touch points of AI enabled systems. AI has a fundamental impact on all humans that it touches – which can be quite different from other technologies
- ONR should work with Programs of Record to provide guidance on common APIs & services (system integration points for AI)
  - Address as part of UNACORN DevOps ???
- There are (innumerable application areas) that DoN needs to identify: e.g. use of AI for generation of AI algorithms & supporting (services) code
  - Need mechanism for identifying & socializing projects in known & new application areas
- Need to enable on-going AI development feedback & best practices across AI project managers, users and researchers
  - Will need to prompt development teams to reflect on their efforts & lessons learned on an on-going basis



# Deployment of Capabilities

