CANARIE

Networks and Service Oriented Architectures

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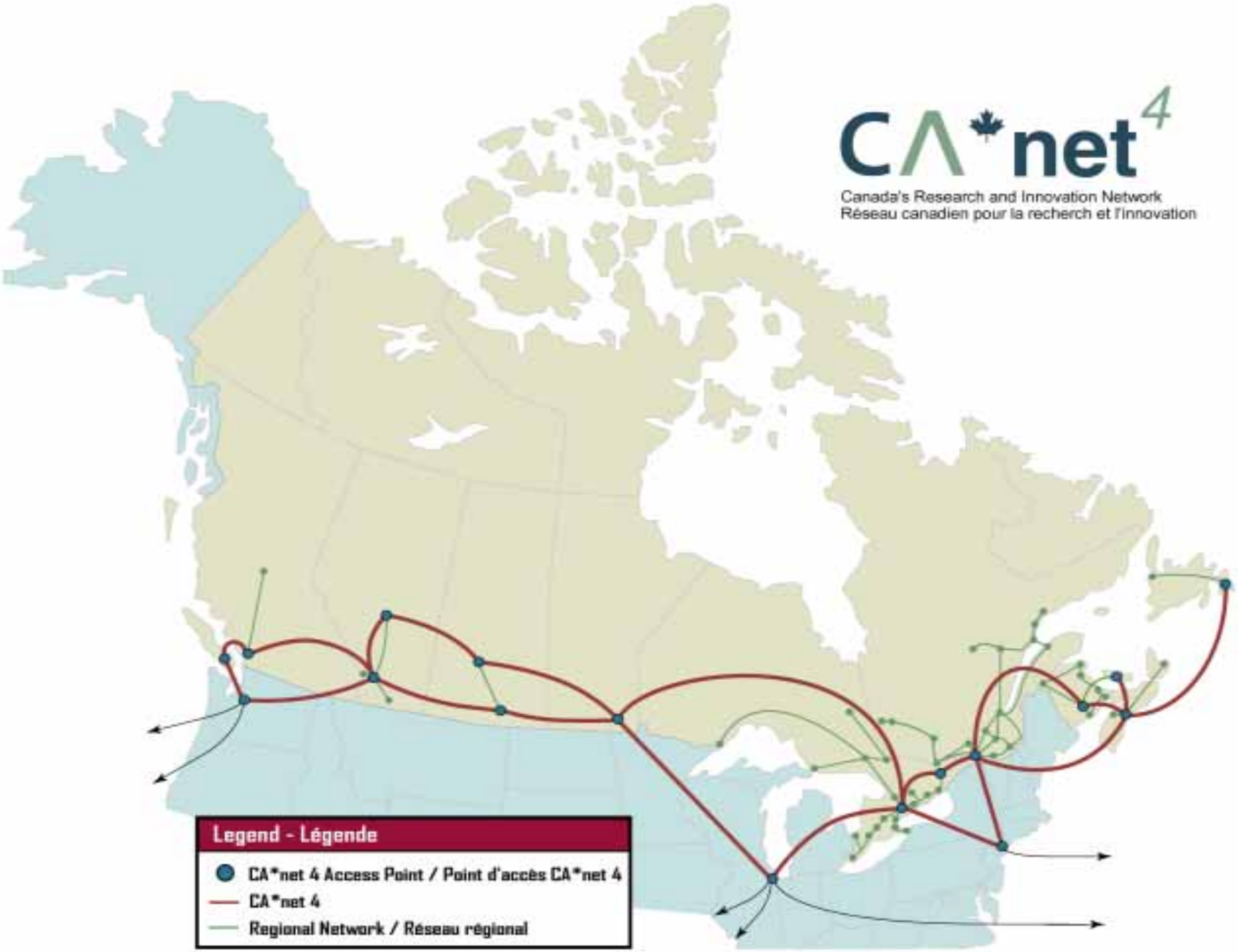
S&T Futures Symposium

CANARIE Inc

- Mission: To facilitate the development of Canada's communications infrastructure and stimulate next generation products, applications and services
- Canadian equivalent to Internet 2
- private-sector led, not-for-profit consortium
- consortium formed 1993
- federal funding of $300m (1993-99)
- total project costs estimated over $600 M
- currently over 140 members; 21 Board members

CA*net 4

Canada's Research and Innovation Network
Réseau canadien pour la recherch et l'innovation



Winter / Hiver 2003

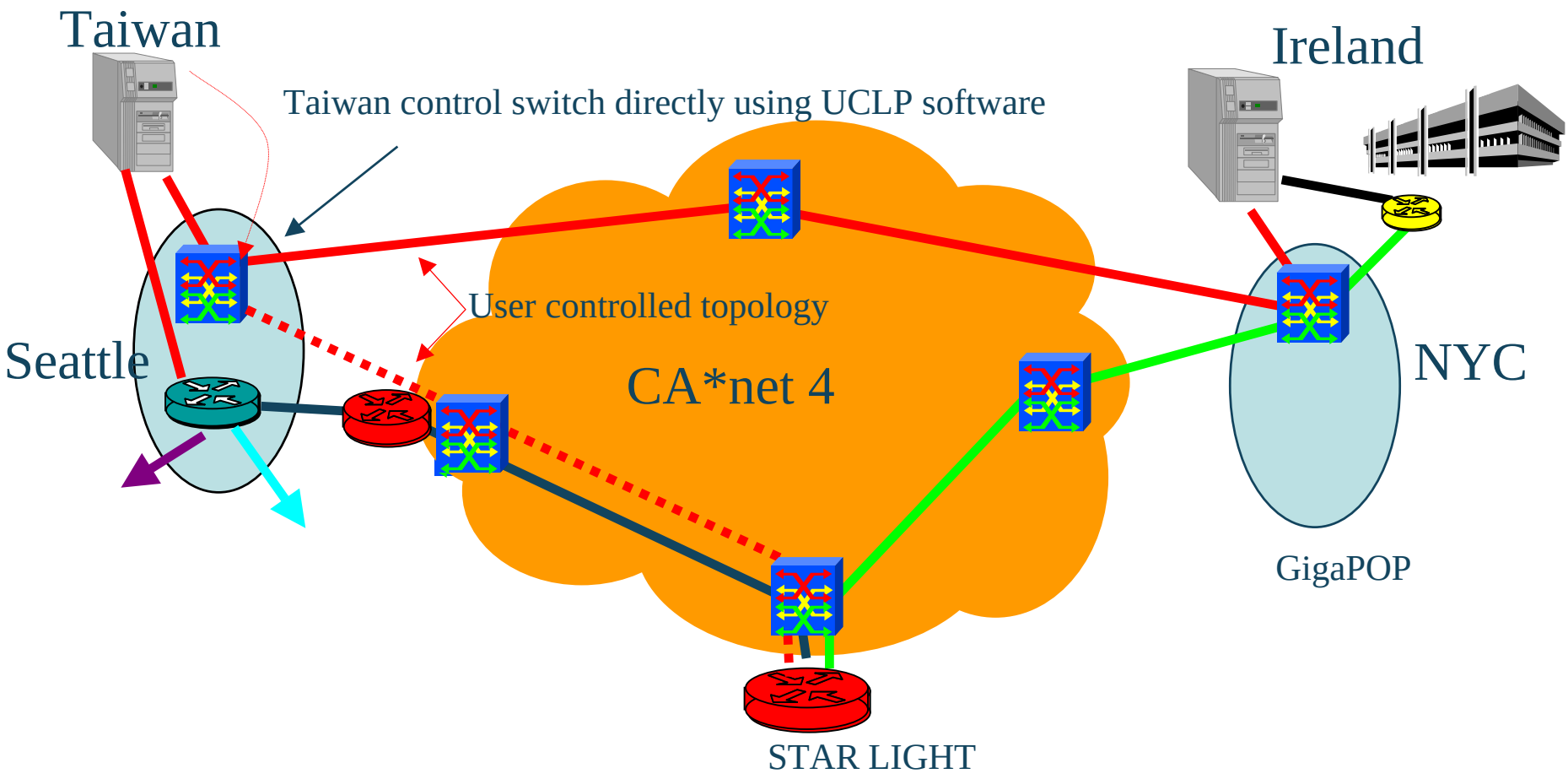
CA*net 4 Update

- World's First customer controlled and managed network
- Evolution of networks is following evolution of the computer
- Taiwan and Ireland have purchase lightpaths across to participate in UCLP research
- Korea and UK about to sign – others in negotiation
- Canada becoming a global hub for next generation networks

UCLP Objectives

- **No central management**
- **Uses state-full web services with SOA**
- **Partitions optical switches into domains that can be managed and controlled by end users**
- **Create discipline specific re-configurable IP networks**
  - Multihomed network which bypasses firewalls with direct connect to servers and routers
- **Allow institutions to integrate wavelengths and fiber from different suppliers and integrate with institution's network management domain**
  - And offer VPNs to users

Taiwan Ireland



Applications

- **Distributed back planes between HPC Grid centers**
  - Westgrid 1 GbE moving to 10 GbE
  - SHARCnet 10 GbE
- **Distributed Single Mount file systems – Yotta, Yotta - SGI**
  - Needs very consistent performance and throughput to truly act as a back plane
  - Frequent topology changes to meet needs of specific applications
- **Canada ATLAS – 980 Gbytes FCAL data once a month from CERN to Carleton U, UoAlberta, UoArizona, etc**
  - Will significantly increase to Terabytes when production runs start
  - Would take over 80 days on IP R&E network

Applications- 2

- **CERN Low level trigger data to UoAlberta with GARDEN**
  - Initially streaming data rates 1 Gbps moving to 10Gbps later in the year
- **Canadian virtual observatory**
  - .5 Tbyte per day to UoToronto and UoHawaii
  - 250 Mbps continuous streaming from CCD devices
- **Neptune – Canada (and US?) under sea laboratory – multiple HDTV cameras and sensors on sea floor**
- **Canada Light Source Synchrotron – remote streaming of data acquisition to UoAlberta**
  - 2 to 5 Gbps continuously
- **Canadian remote Nano and micro electronics laboratories**
- **Canadian military instruction to Czech republic**

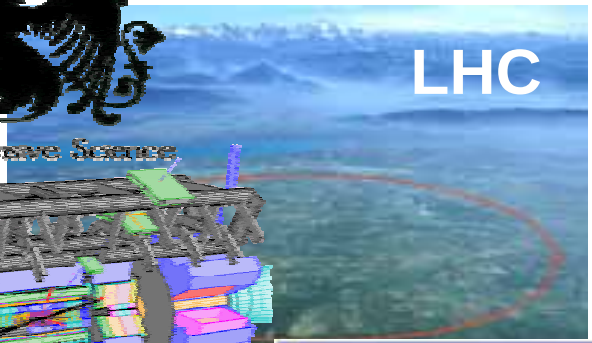
A new way of doing science

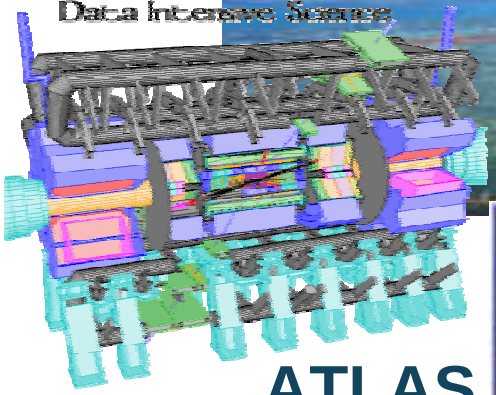
- Science used to about test tubes, wet labs and big instruments
- But increasingly science is moving to networks and computers
- Science is now longer bound by bricks and mortar or geography
- NSF has announced “Cyber Infrastructure” initiative
  - https://worktools.si.umich.edu/workspaces/datkins/001.nsf
- Europe has announce “eInfrastrcuture”
  - http://www.pd.infn.it/einfrastructures/
- Recognition that more and more science is network and computationally based
- Grids using web services will be foundation of this new research methodology

Many e-Research Projects Coming

GriPhyN

Data Intensive Science



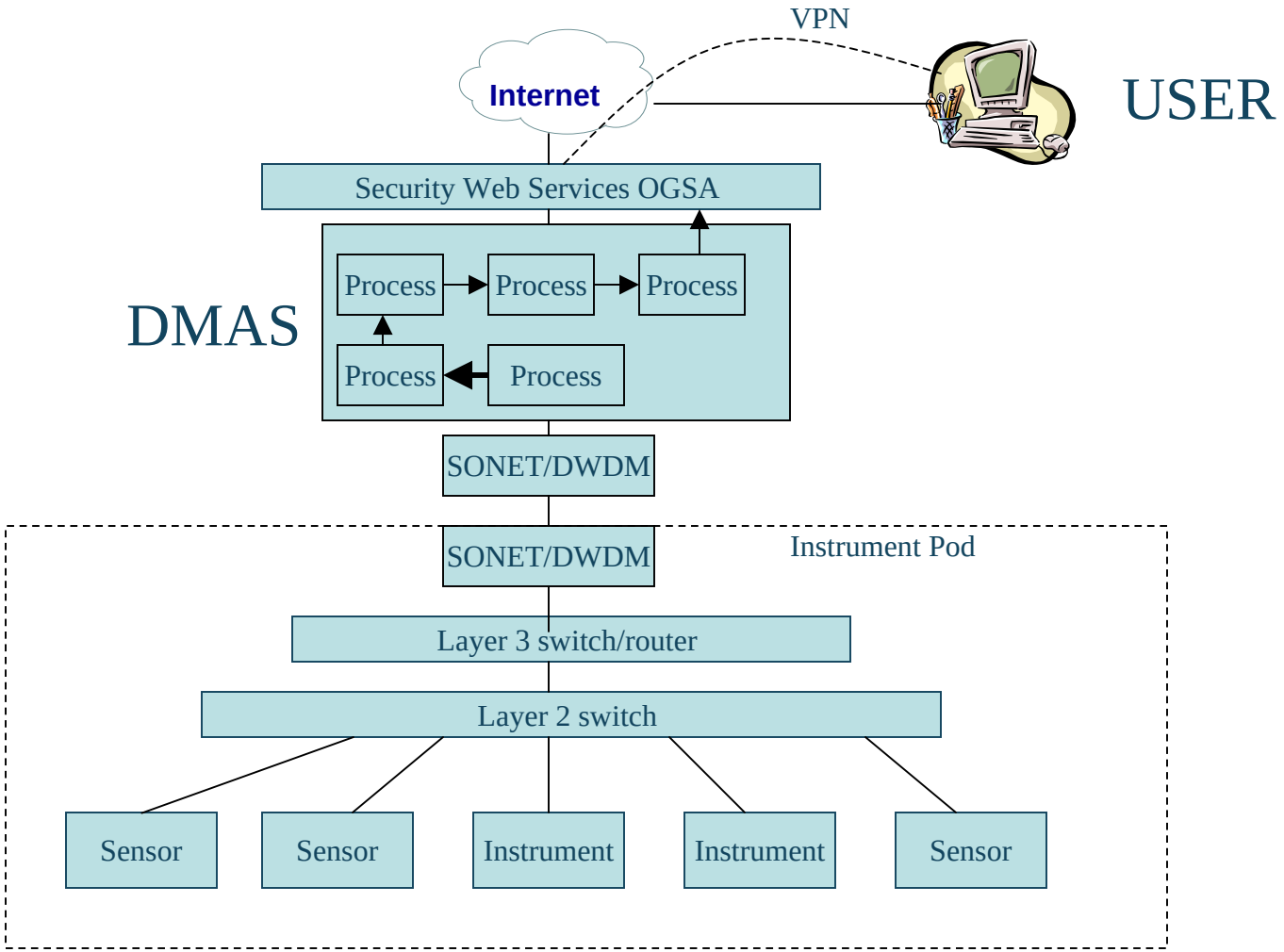


ATLAS

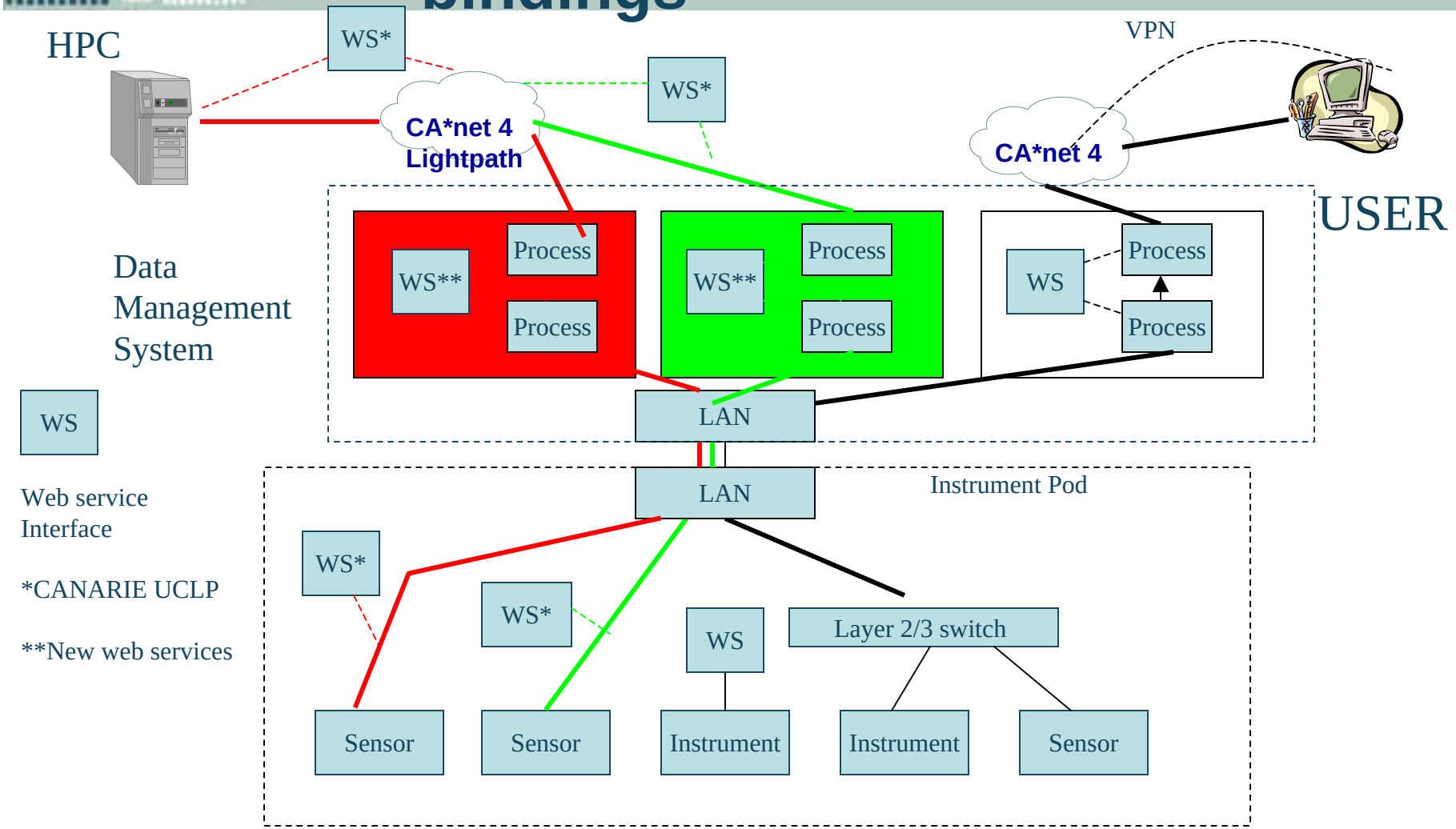
i-Infrastructure

- CANARIE's proposed program for Canadian science and industry
- The computer is no longer the network
- Everything is the network
- To adapt service oriented architecture (SOA) using state-full web services to integrate sensors and instruments into the network
- Building and extending upon our original work in UCLP
- Major applications after science are process control industry and military applications

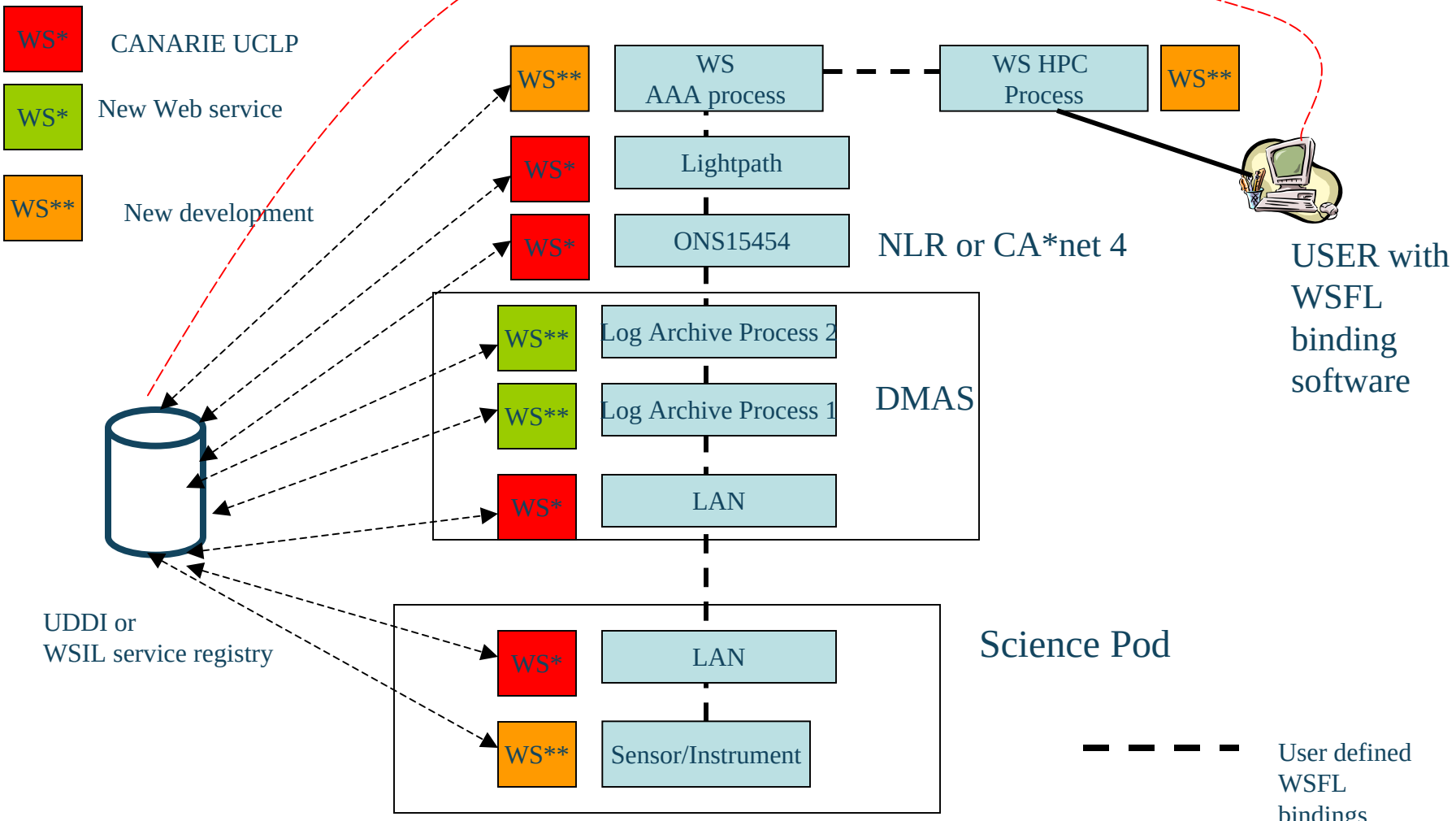
Typical Large system today



Network recursive architecture with web service work flow bindings



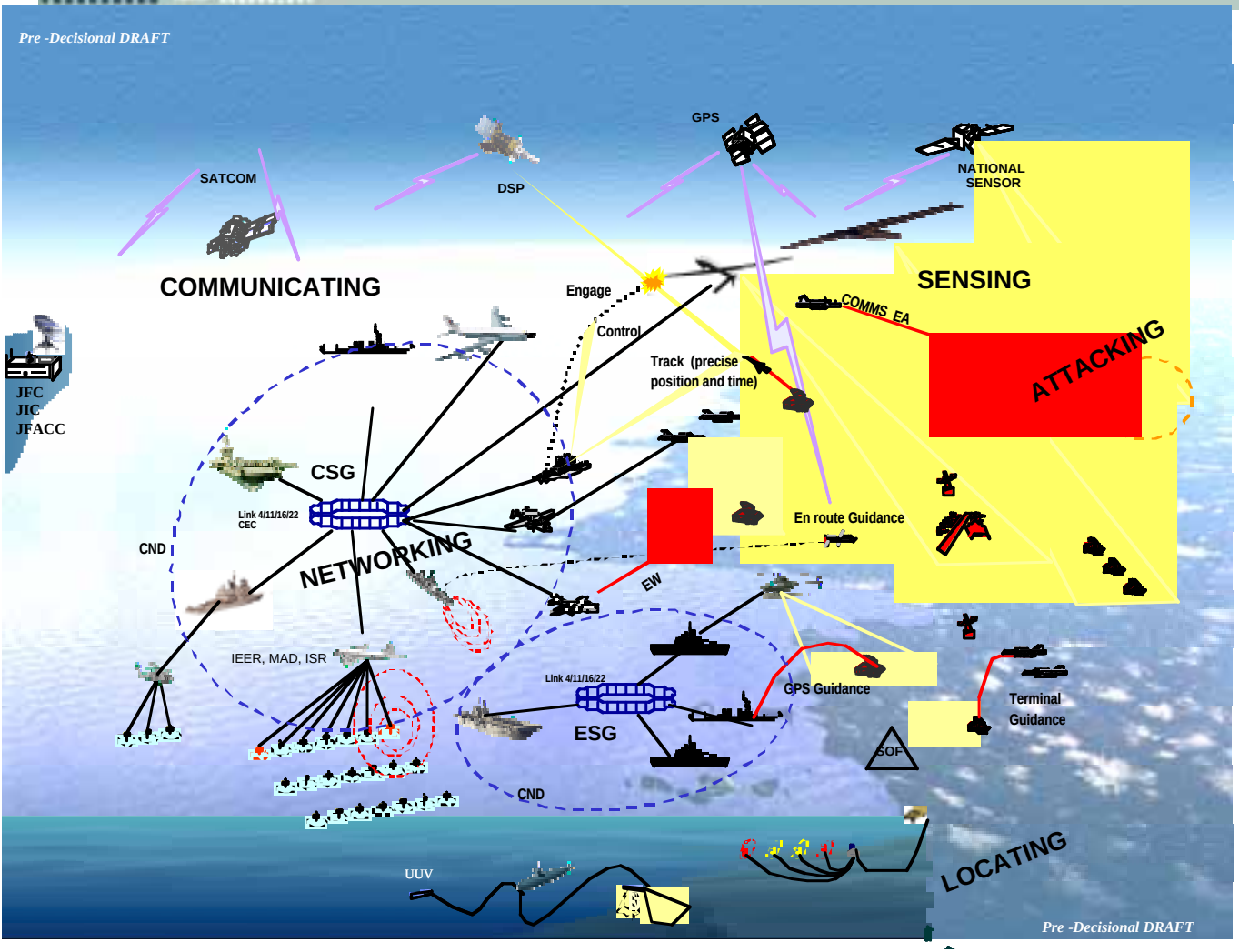
User perspective



Features

- **All hardware (sensors -wireless and wired), software processes (Data processing and HPC) and network elements exposed as state-full web services**
- **Hardware, software and network web services linked together by science user with WSFL user defined late state binding**
  - Some web services may be expressed as abstractions of groupings of other web services
- **Hence all “science” processes use network data recursive architectures**
  - Re use and replication of same modules for software, hardware and network for each science project

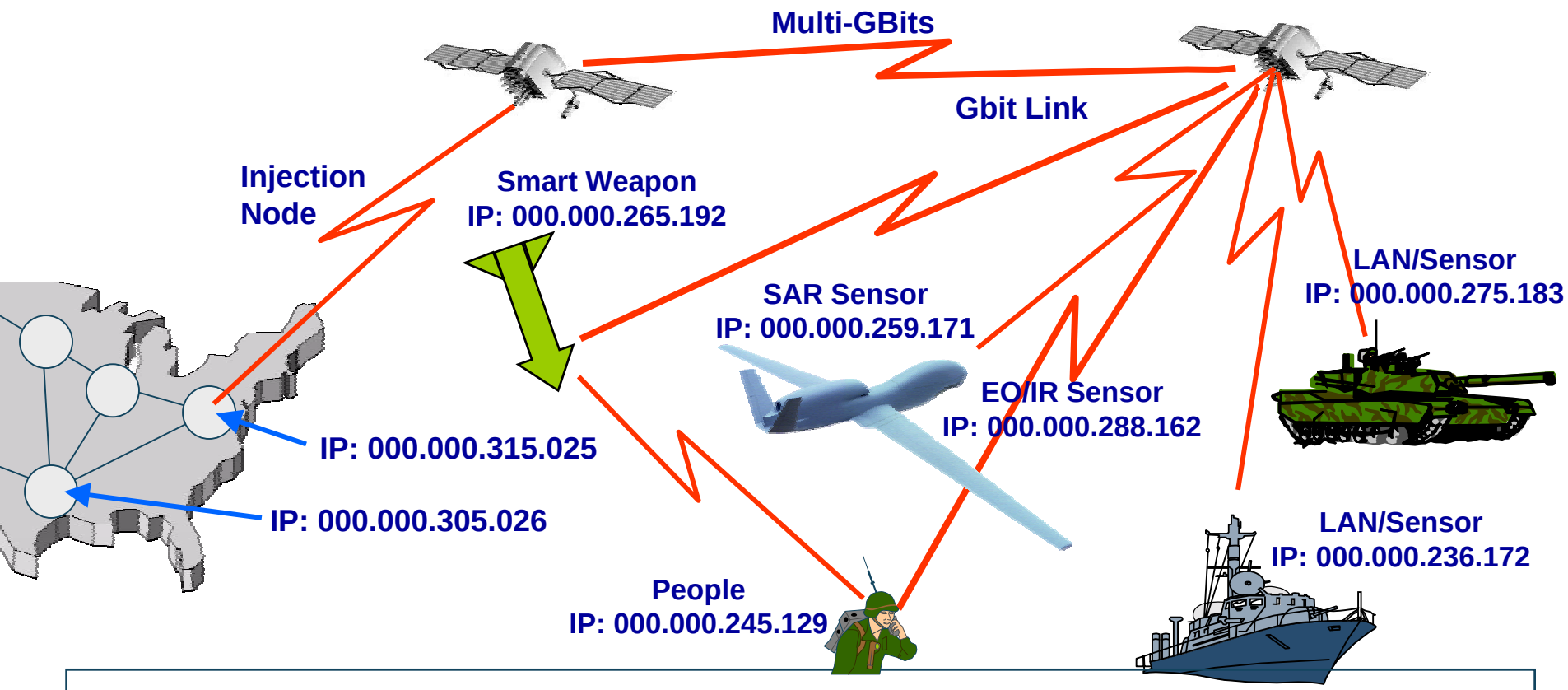
DoD Vision – Integrated Information Infrastructure



- Accomplished using an Architectural Framework based on Open Standards
- Joint Services
- Based on a Distributed Services Architecture (DSA) e.g. a Services-Oriented Architecture (SOA)
- Supports Mission Compose ability

GIG: Integrating The Entities

Transformational Communications Systems



Each Platform And Each Sensor, An Entity Of The GIG, Integrated With Warfighters and Their Applications

GIG: GIG Bandwidth Expansion

Optical IP terrestrial backbone with a ubiquitous presence. Mitigates constraints in terrestrial bandwidth.

- **Diverse physical access to the network, the near term effort secure, robust**
- **CONUS & OCONUS**
- **Key to integrated net-centric transformation**

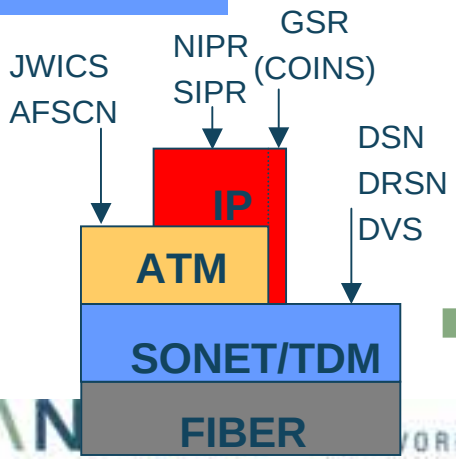
Investment $800+M

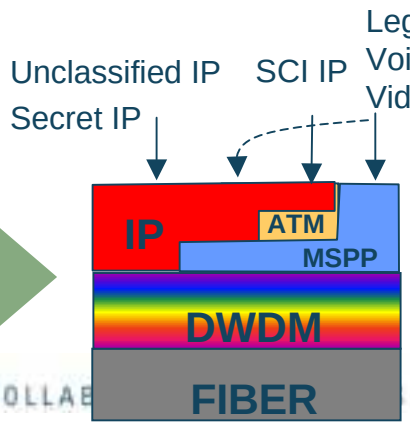
FY03: $500+M
- **Requests for Proposals**
- **Contract awards**
- **Site surveys**
- **Installations begin**

FY04: $300M
- **Complete all installations**
- **Provide minimum 100 Mbps per site per service**

Today:

TDM - CENTRIC

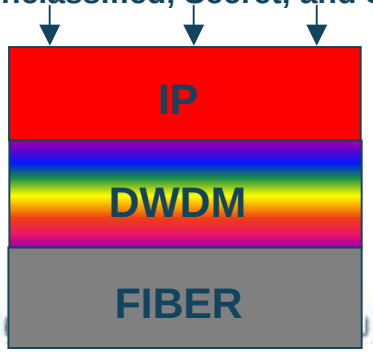




Tomorrow:

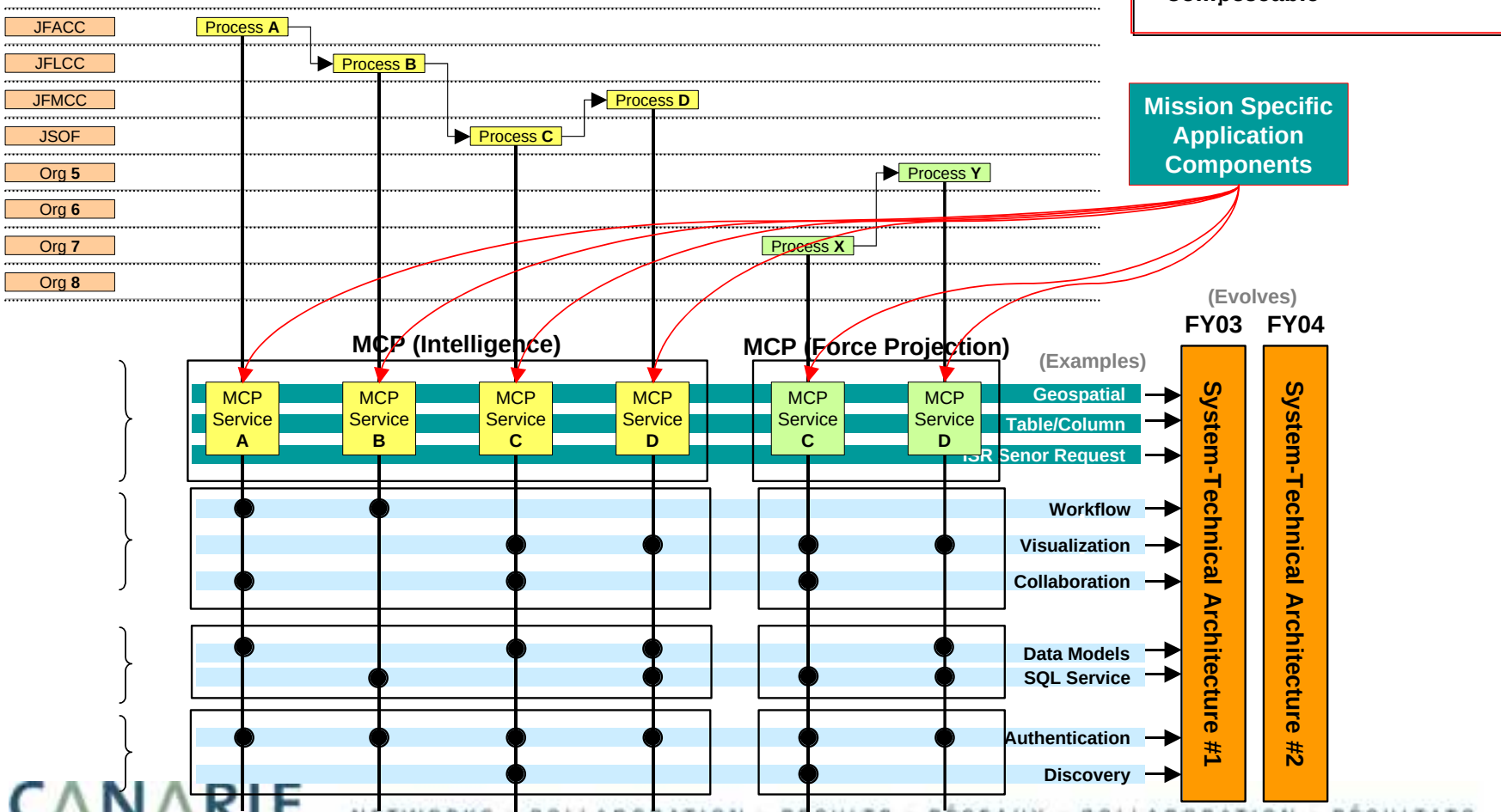
IP - CENTRIC

Voice, Video, and Data at Unclassified, Secret, and SCI



Composing Mission Applications using Distributed Services

- Open Standards
- Joint
- Services Oriented Architecture
- Composeable



Source: Bob Young SAIC

Net-Centric Enterprise Services

Support real-time & near-real-time warrior needs, and business users

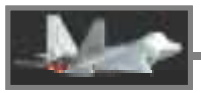
DoD (Title 10) IC (Title 50)

Business Domains

Warfighter Domains

National Intelligence Domain

Users



Installation & Environment | Human Resource Management | Acquisition | Strategic Planning & Budget | Logistics | Accounting & Finance

Business Lead

Command & Command | Battlespace Awareness | Force Application | Protection | Precision Logistics

Warfighter Lead

IC Org Spaces

Domain/ COI Capabilities

Levels of Services Above Core Level

ICSIS Community Space

Application — IA/Security — ESM

User Assistant — IA/Security — ESM

Storage — IA/Security — ESM

Messaging — IA/Security — ESM

IA/Security — ESM

Discovery — IA/Security — ESM

Collaboration — IA/Security — ESM

Mediation — IA/Security — ESM

Enterprise Service Management (ESM) — IA/Security

Core Enterprise Services (CES)

Technical Infrastructure Domain

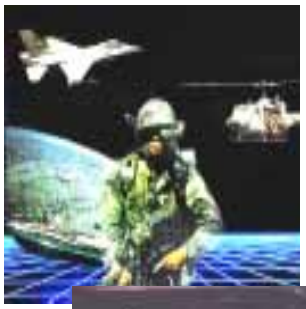
Transformational Communications (TC) & Computing Infrastructure

Source: Bob Young SAIC

GIG: DoD Investments

The Global Information Grid

Development Strategy



- GIG Bandwidth Expansion (GIG-BE)
- Transformational Communication Satellite (TCS)
- Joint Tactical Radio System (JTRS)
- Net-Centric Enterprise Services (NCES)
- Horizontal Fusion (HF)
- Distributed Common Ground Station (DCGS)
- Global Command and Control System (GCCS)
- Crypto Transformation Program

A Subset Of Several Key Initiatives