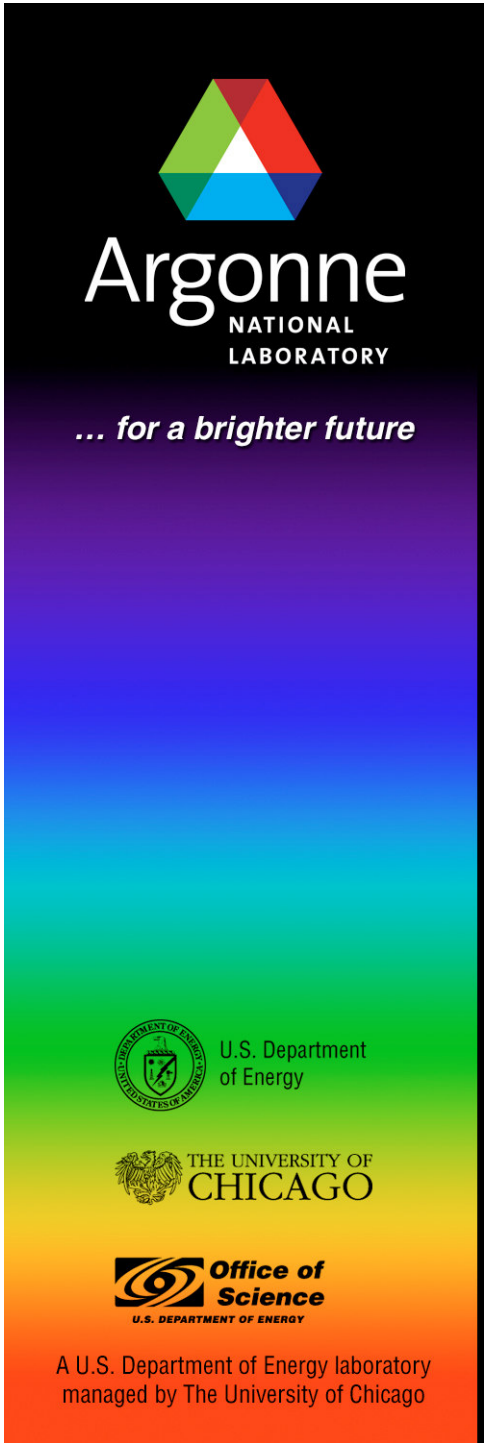

Infrastructure Monitoring System for the Advanced Photon Source Control System

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PCaPAC2008

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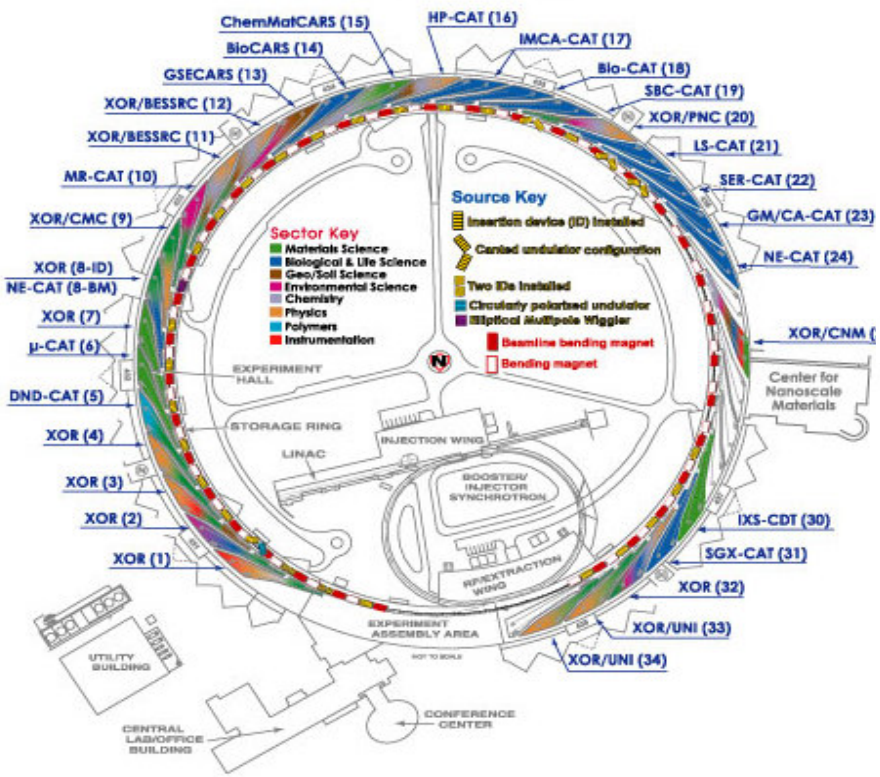
Advanced Photon Source (APS)



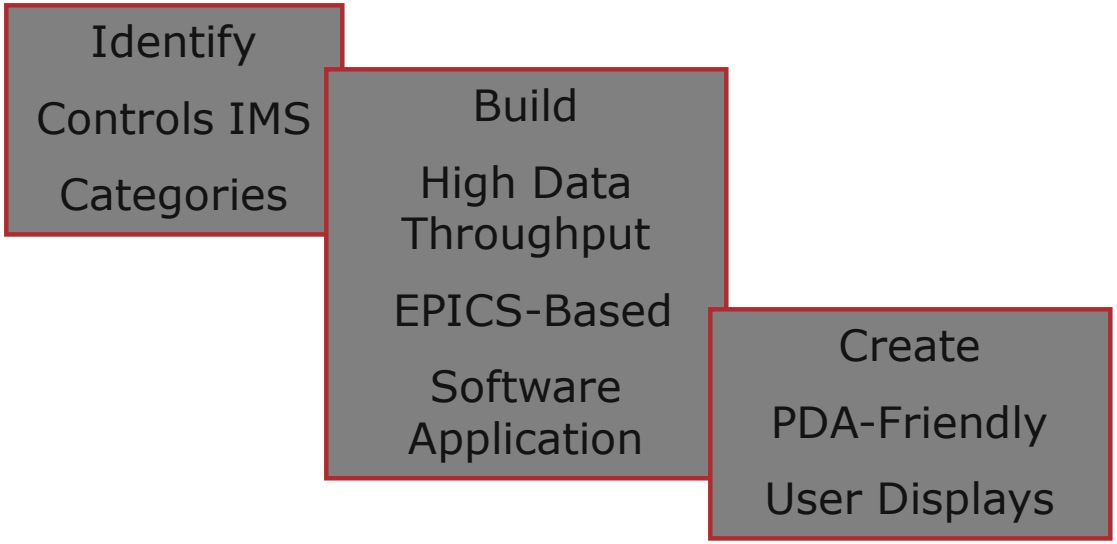
Complexity and Scale of APS Control System

Linac, PAR, Booster and Storage Ring

- Over 30 Controls Group servers (Solaris, Linux, Mac)
- Approximately 300 distributed input/output controllers (IOCs)
- EPICS supervisory real-time controls software is interfaced by PLCs, LabView, FPGAs, and Johnson Controls distributed control systems
- More than 12,000 replaceable hardware components
- Over 100,000 IOC points that monitor and control more than 450,000 technical parameters
- Nearly 1,000 unique control system software applications

Goals of APS Controls Infrastructure Monitoring System

Exhaustively monitor all parts of the control system and provide immediate notification to the on-call controls staff of an exception, in many cases even before the machine operators notice the impact on machine performance.



Define Controls IMS Categories

10 Major Categories

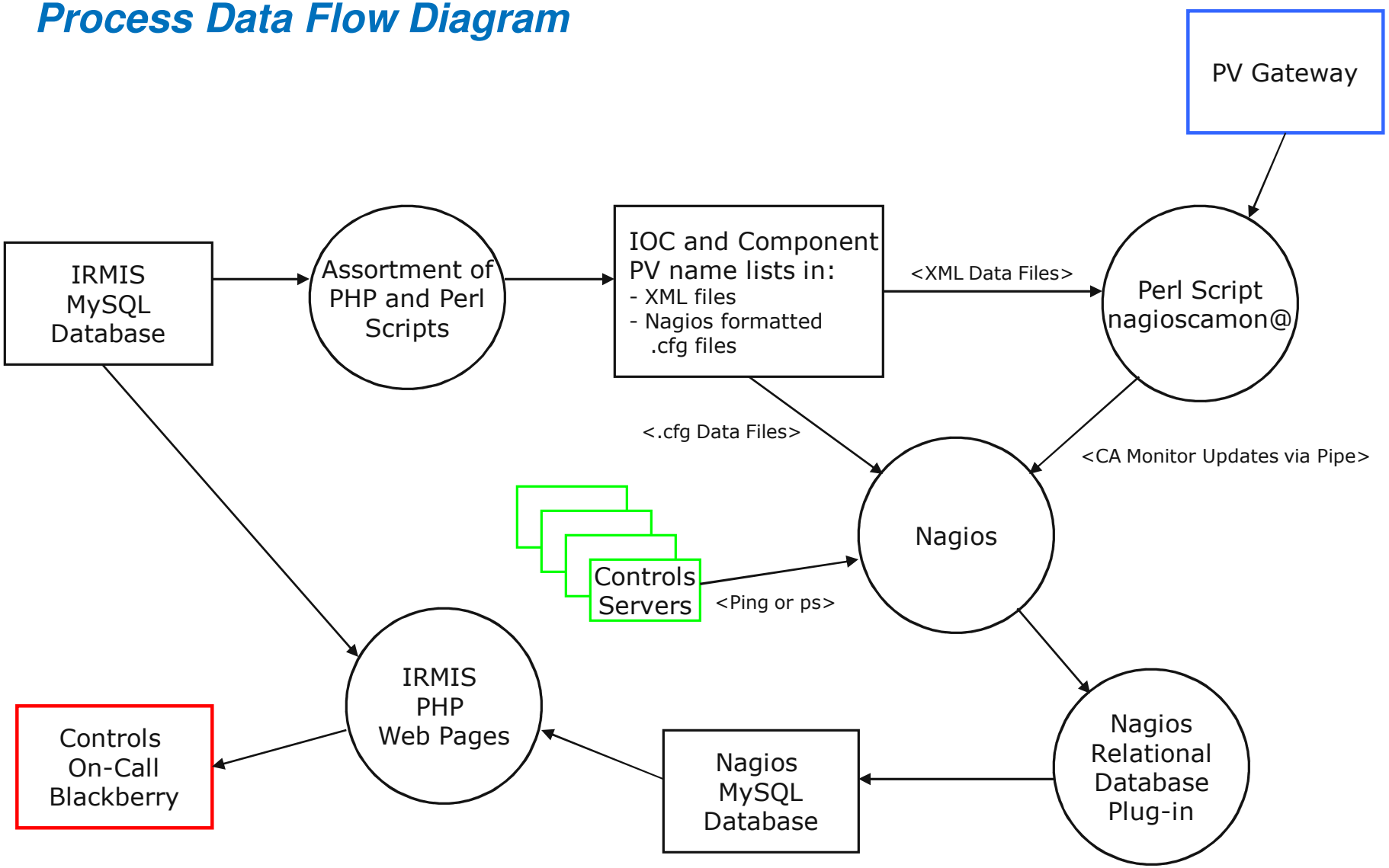
- Applications Organizing Index (AOI)
- Component Communication Monitoring System (CCMS)
- Controls Servers
- Event Receivers
- IOCs
- Machine Status Link
- Nagios Software Components
- PV Gateway
- Timing
- VME/VXI Power Supply

Currently, a mixture of 2,489 EPICS PVs, processes, and servers are being monitored by the APS Controls IMS

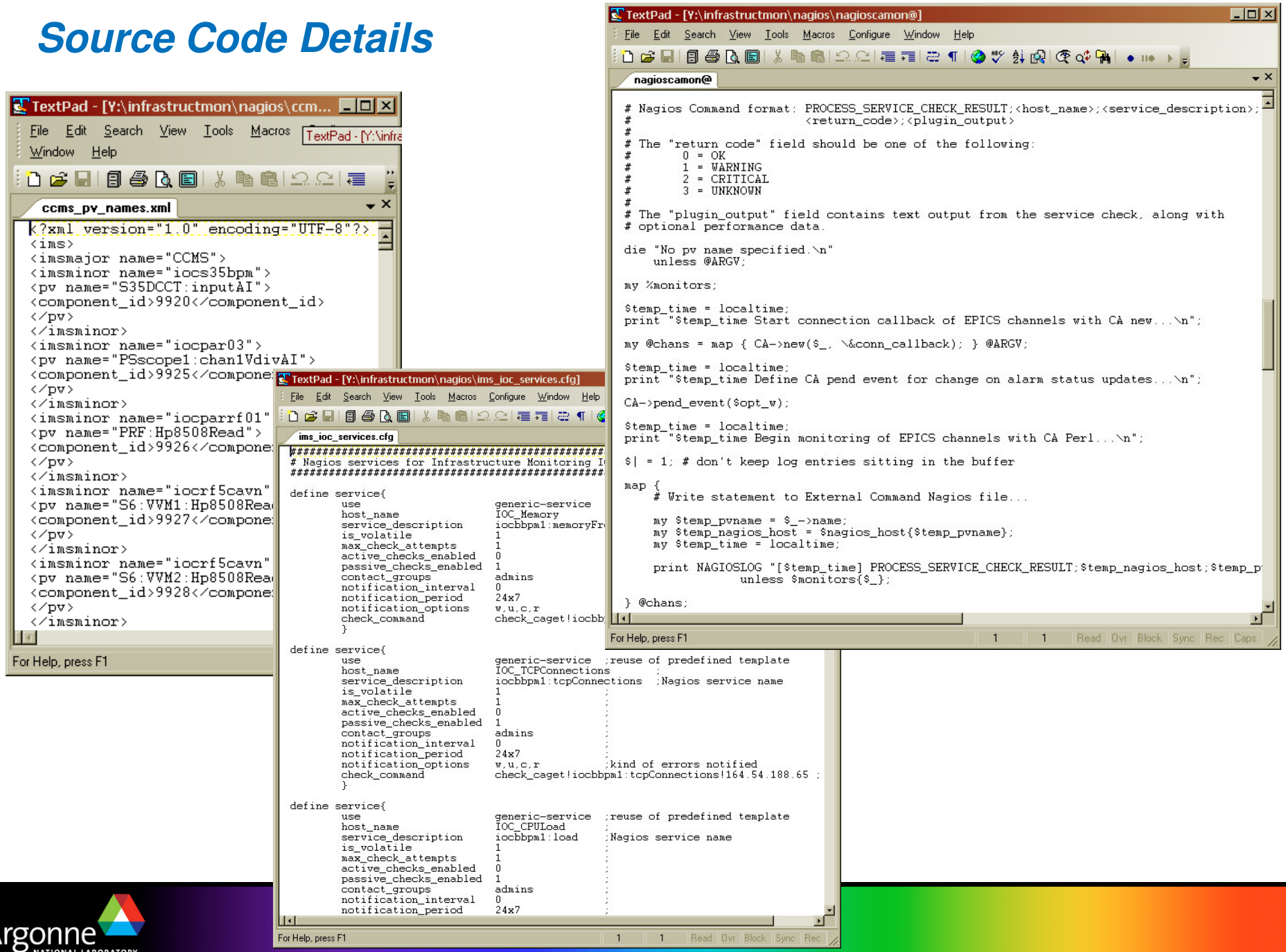
APS Controls IMS Software Architecture

- Nagios open source software
  - Designed for IT administrators to monitor servers, routers, processes, …
- MySQL relational database software
- Nagios NDOUTILS plug-in for Nagios database schema
- Perl script built in-house with EPICS Channel Access monitor callbacks
  - Utilizes Perl interface to Channel Access library
- Nagios EPICS plug-in with EPICS Channel Access caget
  - Written by Mauro Giacchini (mauro.giacchini@lnl.infn.it) and modified by D. Quock
- IRMIS PHP Web pages
  - PDA-Friendly
- Assortment of PHP and Perl scripts that manually generate the lists of PVs to be monitored

APS Controls IMS
Process Data Flow Diagram



Source Code Details



EPICS-to-Nagios Translation

EPICS Alarm Severity	Nagios State
(none)	OK
MINOR	WARNING
MAJOR	CRITICAL
PV Readback INVALID	CRITICAL
PV Name Not Found	UNKNOWN

APS Controls Infrastructure Categories-to-Nagios Translation

APS Controls 10 Major Infrastructure Categories

- AOI
- CCMS
- Controls Servers
- Event Receivers
- IOCs
- Machine Status Link
- Nagios Software Components
- PV Gateway
- Timing
- VME/VXI Power Supplies

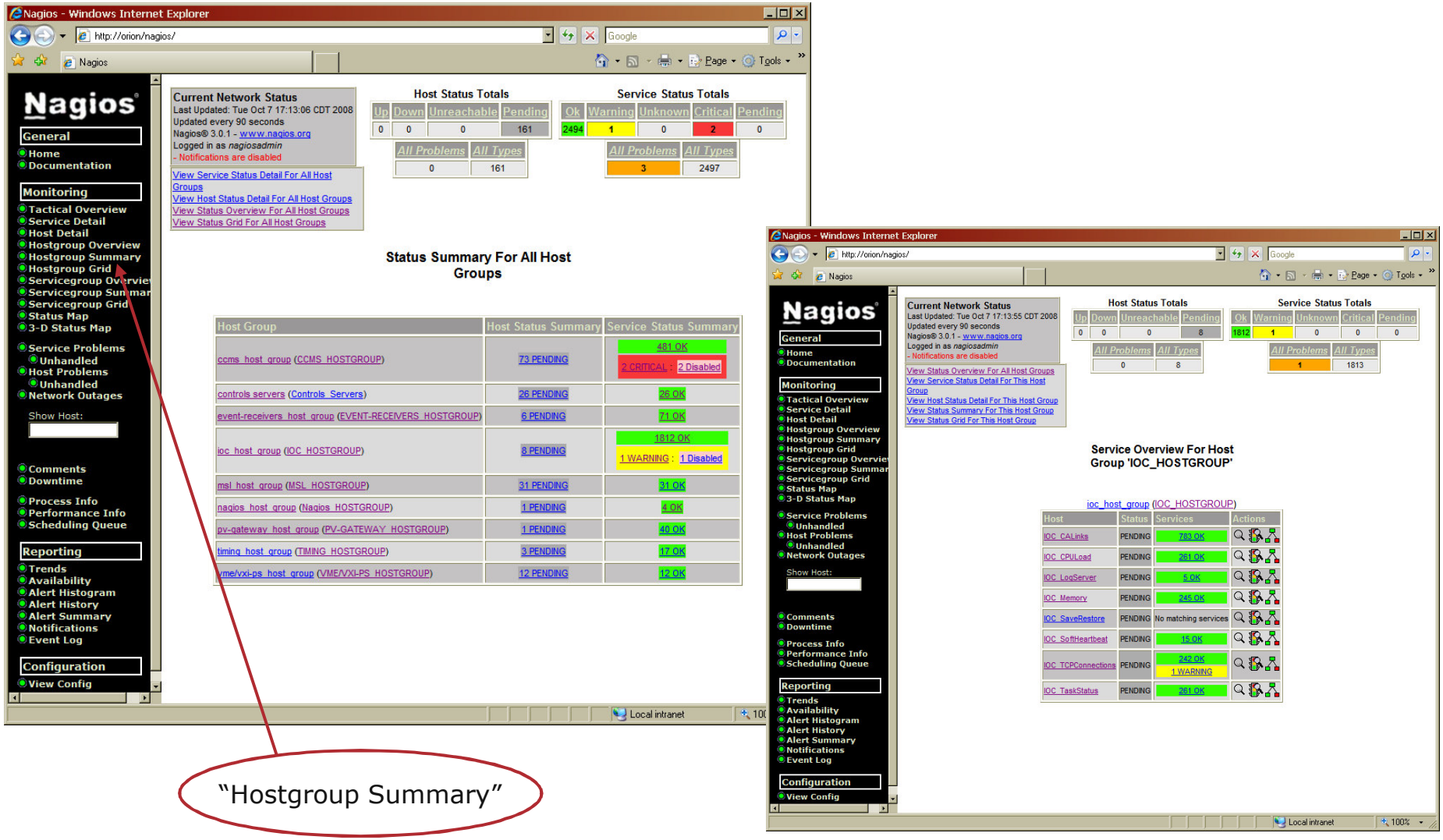
Nagios Software Design Hierarchy

- Used 3 Levels for APS Controls

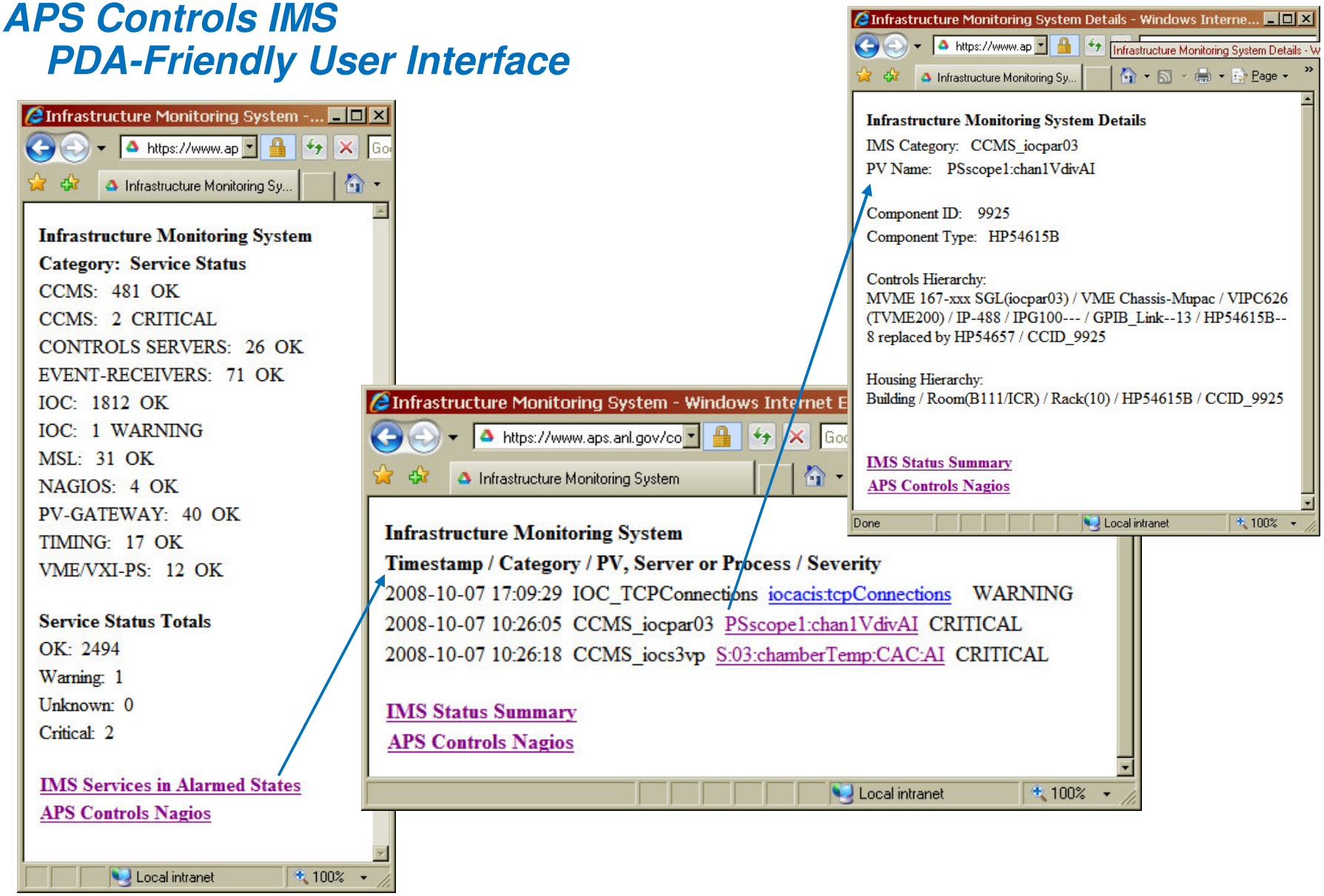
- Host Group
  - Host
    - *Service*
    - *Service*
    - …
- IOC
  - CALinks
    - *iocacis:ascaDisco*
    - *iocacis:dbcaDisco*
    - …
  - CPULoad
    - *iocacis:load*
    - *iocbbpm1:load*
    - …

Here, EPICS PV Name
(but not always…)

APS Controls IMS
Nagios User Interface



APS Controls IMS
PDA-Friendly User Interface



IMS Future Enhancements

- Add approximately 1,000 designated EPICS PVs that convey the health of accelerator controls applications (AOIs).
- Add ~300 IOC EPICS SaveRestore status readback PVs.
- Continue to refine and add estimated 2,200 Component Communication EPICS PVs (CCMS). Only 481 CCMS PVs are included in IMS thus far.
- Create Nagios event handlers that automatically respond to loss of critical processes and take corrective action.

Acknowledgements

- Bill Sheehan, Dave Cyl, Roger Sersted, Mike Jarka, and Mary Westbrook
  - IT staff at the Advanced Photon Source

- Tim Mooney, APS BCDA Group
  - New EPICS autosave heartbeat PV created for APS Controls IMS
  - Available in EPICS Release 3.14.8+

- Nagios http://www.nagios.org/